SEPTEMBER, 1951

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

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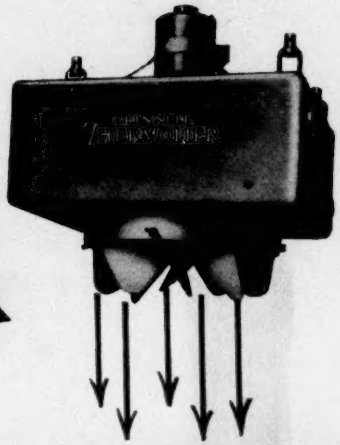
DOWNRIGHT

better performance

Vertical Delivery
THERMOLIER
Unit Heaters . . .



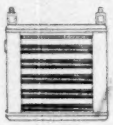
RIGHT DOWN

where maximum heat is desired...

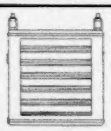
in warehouses, plants and other hard-to-heat buildings

4 MODELS . . . . . 18 SIZES

Vertical Delivery



Horizontal Delivery



Textile Model

Velocity Nozzle

A thermostatic trap, the simplest and least expensive of all traps, is practical because of Thermolier's exclusive cooling leg.

Maximum capacity assured, annoying destructive water hammer eliminated — by built-in pitch of tubes and internal cooling leg which assure continuous drainage of condensate.

Damaging strains caused by expansion and contraction eliminated by "U" type expansion tubes.

Safety and durability assured with leak-proof tube-to-header construction.

Five other important construction features. Write for Thermolier Catalog.

HEATING COMFORT AND ECONOMY. Heat is forced down to the working level . . . not banked uselessly at the ceiling level. Thermoliers provide quick heating from a cold start. Desired room temperatures are easily maintained within a close range.

ADAPTABILITY TO EQUIPMENT AND FLOOR LAYOUT. The units and the simple piping are overhead where they do not interfere with arrangement of operating machinery or equipment and do not take up valuable floor or wall space. Units are easily relocated at any time to meet changes in plant layout or heating requirements.

LOW FIRST COST. Thermoliers are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost.

GRINNELL

WHENEVER PIPING IS INVOLVED

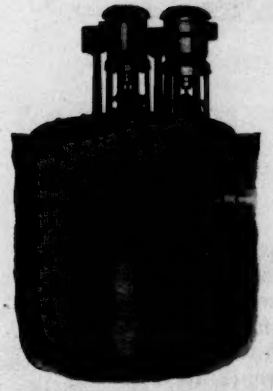
Grinnell Company Inc., Providence 1, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

weil *Condensate Pumps*

ENGINEERED TO SOLVE YOUR PROBLEMS

Specify the pumps engineered to do the best job! There is a **weil** pump for every heating problem and unusual condition. Ratings, receiver capacities and performance of **weil** pumps meet ASHVE standards.



FOR UNDERGROUND INSTALLATIONS

NRG

Requires minimum space.

Send for
BULLETIN NRG 200-C
Tells you when to use and how to efficiently install an underground condensate pump.

FOR LOW PRESSURE SYSTEMS

TVC

LOW RETURN
CAST IRON RECEIVER
Capacities to 10000 EDR
Send for
BULLETIN TVC 300-B

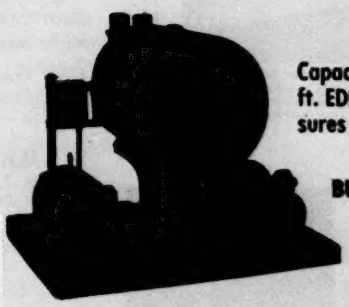
Available from Jobbers' Stocks
TVC-29—2000 Sq. Ft. E.D.R., 20# P.S.I.
TVC-35—4000 Sq. Ft. E.D.R., 20# P.S.I.

SEND FOR DESCRIPTIVE BULLETINS INTELLIGENTLY DESIGNED TO MAKE PUMP SELECTIONS AND INSTALLATIONS SIMPLE AND EFFICIENT

FOR CAPACITIES TO 50000 SQ. FT. EDR

SRC

Send for
BULLETIN SRC 450



FOR HIGH AND LOW PRESSURE SYSTEMS

TR

Capacities to 150,000 sq. ft. EDR and discharge pressures to 125 lbs.

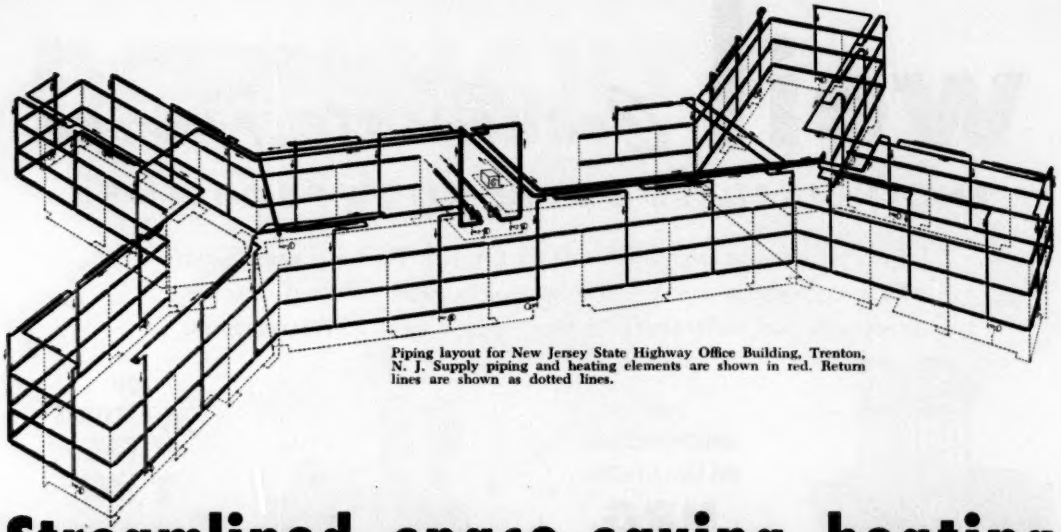
Send for
BULLETIN TR 100-D

THE EFFICIENCY OF YOUR HEATING PLANT IS DEPENDENT UPON EFFICIENCY AND DEPENDABILITY OF YOUR CONDENSATE RETURN PUMP

weil PUMP CO.
1523 N. FREMONT ST. CHICAGO 22, ILL.

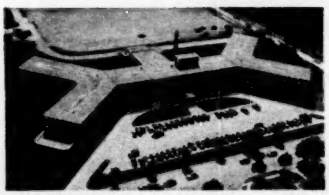
weil *Dependable* **PUMPS**

IN SWEET'S
1951-1952



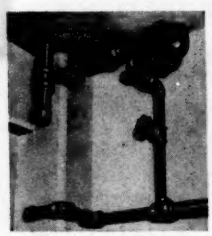
Piping layout for New Jersey State Highway Office Building, Trenton, N. J. Supply piping and heating elements are shown in red. Return lines are shown as dotted lines.

Streamlined space-saving heating



Aerial view of New Jersey State Highway Office Building. Mickiewright & Mountford, Trenton, Architects. Runyon and Carey, Newark, Consulting engineers. Philip S. Slack & Co., Trenton, Heating Contractors.

Webster Walvector spreads the heat . . . no cold spots. Note supply and return risers; location of Walvector trim piece connections below window mullions facilitating installation of office partitions.



Typical Drip Connection.

Moderator Control Valve.

The new $1,700,000 headquarters and office building for the New Jersey State Highway Department, sponsored by Governor Alfred E. Driscoll, is marked by three innovations: (1) for economy, streamlined modern design in place of usual monumental architecture; (2) for efficiency and parking ease, location outside of city; (3) streamlined, space-saving heating with Webster Walvectors. The alert cooperation of contractor Philip S. Slack in working out details of the new developments with the architects and engineers, contributed much to the success of the installation.

A Webster Moderator System provides "Controlled-by-the-Weather" heating for this modern building with Webster Walvectors equipped with integral tube orifices to spread the heat along exposed walls. Webster Convectors are used in stairways and Webster-Nesbitt Unit Heaters provide supplemental heating in corridors.

Call the authorized Webster Factory Representative or write us for his name.

Address Dept. HV-9

WARREN WEBSTER & COMPANY

Camden 5, New Jersey : : Representatives in Principal Cities

In Canada, Darling Brothers, Limited, Montreal

WEBSTER

MODERATOR

SYSTEM

OF STEAM HEATING

"Controlled by the weather"

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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2506 W. 8th Street.

Published by

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

President
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Secretary and Publishing Manager
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Subscription Rates

Subscription rates in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, one year, $5; two years, $9. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

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The Contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index

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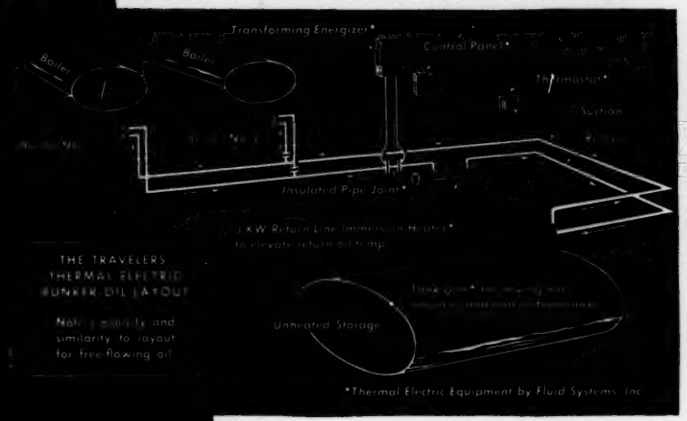
Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.

THIS MONTH'S COVER

In the fabrication of a Monel tube heat exchanger, 14 gage annealed and stress-relieved Monel tube, ⅝ inch diameter, was bent on the mechanical equipment shown. Photograph, courtesy of The International Nickel Co., Inc.

'The Travelers' Buys Bunker Insurance!

THE TRAVELERS Insurance Company of Hartford, Conn., has long-term insurance against bunker oil heating problems. They use a Thermal Electric Standard System to remove bunker oil from *unheated* storage and transport it to the pump-type burners at a precisely controlled flow temperature. ☆ Fully automatic, all-electric operation eliminates remote pump-sets, multiple suction lines, and complicated recirculation equipment. This gives Travelers extra dividends in the elimination of maintenance costs for bunker transport. ☆ We write insurance, too. We've *guaranteed* the Travelers installation, as we guarantee all correctly installed Thermal Electric Standard Systems, to give 100% trouble-free performance!



HOW IT WORKS

The Thermal Electric Transforming Energizer passes safe 20-volt current through the pipes that carry the fuel, generating even heat. The Thermostat and Control Panel automatically regulate the fuel temperature at 120°F. During shutdown, fuel can be kept heated in the pipes without constant or cycle burner operation. System can be shut off without draining — Thermal Electric will melt out the pipes electrically.

Send in the coupon and get the whole story of how Thermal Electric can give you the same advantages.

PAT. NO. 2,224,402

Thermal Electric Fluid Systems INC

Fluid Systems, Inc., 1881 Dixwell Ave., New Haven, Conn.

Please send without obligation "The Common Sense of Heavy Fuel Transport" plus Customer List of hundreds of users, including many insurance firms.

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Firm _____

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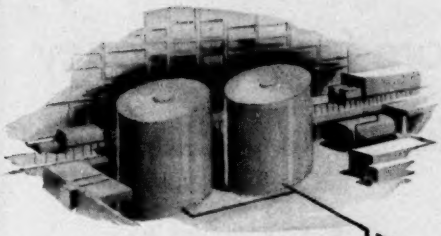
Making Wax Work for American Can Company



Liquid paraffin is a temperamental fluid. If it gets too cool, it clogs. If it gets 5°F. too hot, it oxidizes, making it unfit for use. Thermal Electric, the modern method of transporting heated fluids, can regulate paraffin within ±1°F. of the design temperature (usually 160°F.) over any distance, through any variety of ambient temperatures, during any condition of flow. ☆ There is no need for constant circulation, thus there are no return lines. *One-way transport reduces piping 70%.* All-electric operation eliminates steam or water heating with all their costs and maintenance headaches. ☆ Small wonder that this leader in the food container field has consistently selected Thermal Electric to handle its process fluids!

Pump

Transforming Energizer★

Thermostat★

Switch

Contactor

Transforming Energizer★

The American Can Company uses 79 Thermal Electric systems to heat 8,016 feet of pipe in nine plants. The Thermal Electric principle of passing low-voltage current through the pipe walls works with any fluid. Canco uses Thermal Electric for paraffin, asphalt, outdoor water lines, and sealing compound.

★Thermal Electric equipment by Fluid Systems

Consult Fluid Systems, Inc., for specialized engineering aid in designing pipe transport of process fluids.

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Thermal Electric Fluid Systems INC

Fluid Systems, Inc., 1881 Dixwell Ave., New Haven 14, Conn.

Please send without obligation ☐ "Liquid Paraffin—A Survey of Handling Methods" or ☐ "Simplified Industrial Fluid Transport Cuts Costs".

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STRONGER FRAMES • REINFORCING RODS
MORE MEDIA • HOLDS MORE DIRT • EASIER TO CLEAN
HERRINGBONE-CRIMP MEDIA DESIGN • HANDLES 50% MORE AIR PER UNIT

You get measurably more for your money in FAR-AIR® Filters!

These and many more quality features make FAR-AIR Filters the choice of discriminating organizations. They are available in a wide range of types and sizes for dirt, lint, grease, entrained water, ink, paint and most other filtering applications. Sturdy construction and precision engineering gives them longer service life.

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"Better by Farr"

FARR COMPANY *Manufacturing Engineers*

Los Angeles • Chicago • New York

M'f'd under license by Control Equipment Co. Ltd. Montreal, Canada

Don't Waste It

In most plants and institutions hot water is stored for periodic use in process work, gang showers, group wash basins, etc.

Much of this water (often carried at 180 or 200° F) is wasted by allowing manual temperature adjustment at the point of use.

Avoid buying additional Water Heater capacity by installing Sarco Water Blenders.

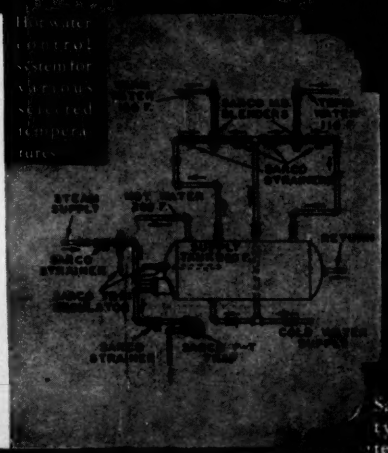
Blend It

They add cold water to the hot from the storage heaters to secure the exact temperature desired at the point of use. In effect, storage capacity will be increased by preventing waste.

Catalog 802 tells the whole story.

Write for free copy today.

SARCO COMPANY, INC.
Empire State Building, New York 1, N. Y.
Represented in Principal Cities
Sarco Canada Ltd., Toronto 5, Ontario

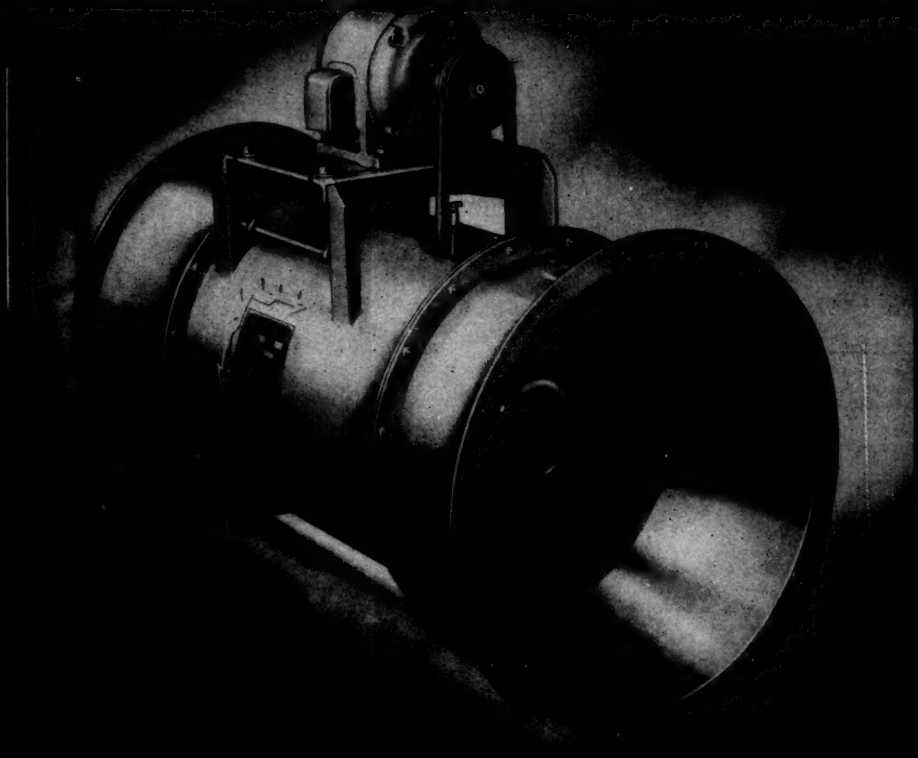


Sarco Water Blender type MB provides tempered water at any desired constant temperature.

Sarco Water Blenders

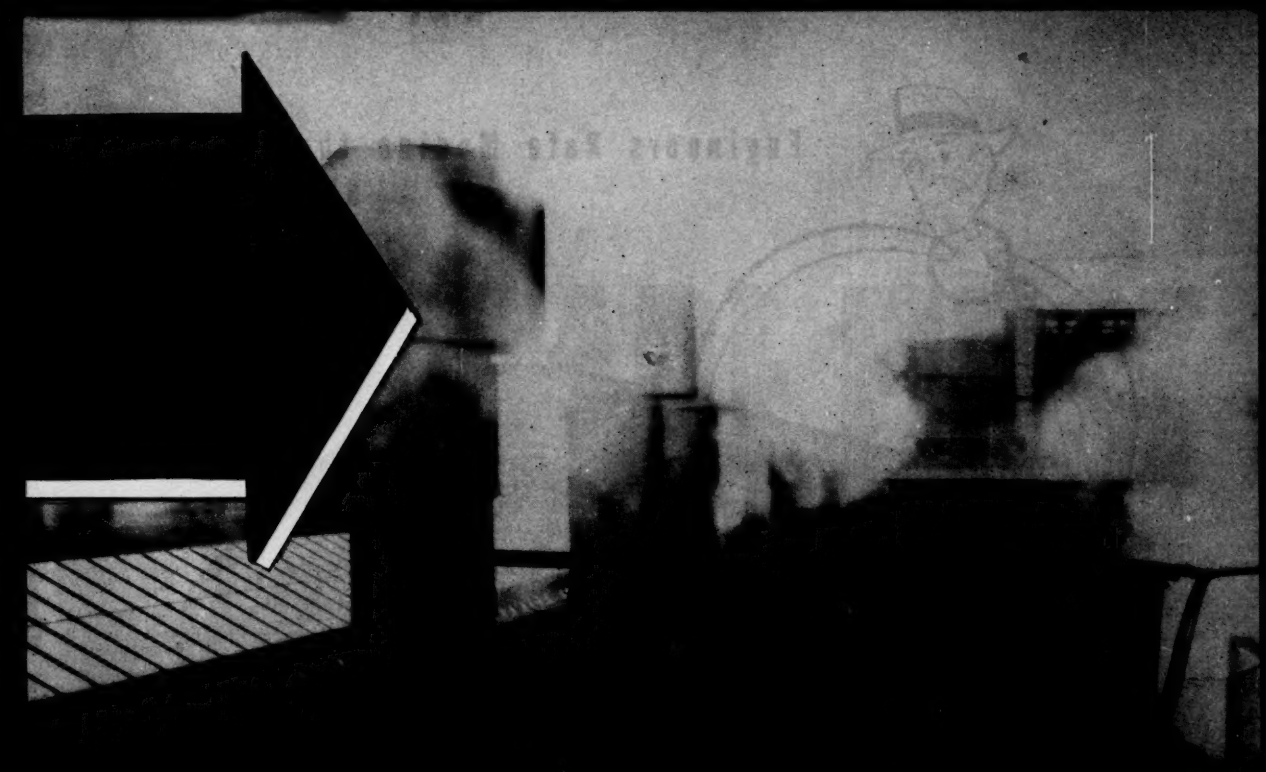
Efficient Exhaust and NO SPACE WASTED

"Buffalo" VANEAXIALS MOUNTED IN VERTICAL EXHAUSTS



Yours!

This helpful Bulletin No. 3533-C describes "Buffalo" Axial Flow Fans and their uses. Write for your copy!



ROOF INSTALLATION OF PAPER COMPANY POINTS WAY TO SAVINGS IN MANY INDUSTRIES

Steam is removed continuously in the view above, as some of the ten 36" "Buffalo" Type "B" Vaneaxial Fans mounted in roof exhausts of West Virginia Pulp and Paper Co., Mechanicville, N.Y., are shown in operation.

Note how the fans fit in like a section of pipe. Their light weight obviates heavy, expensive mountings, and the fans waste no space. The steam comes from hoods from Nos. 5 and 6 paper machines — and passes straight through the pipes and fans with absolute minimum resistance. (In the view of the "Buffalo" Axial Flow Fan at left, note how motor is entirely removed from air stream.)

Whenever YOU need fans for mounting in straight duct runs, you'll save money with "Buffalo" Vaneaxials!

"Buffalo" FIRST FOR FANS

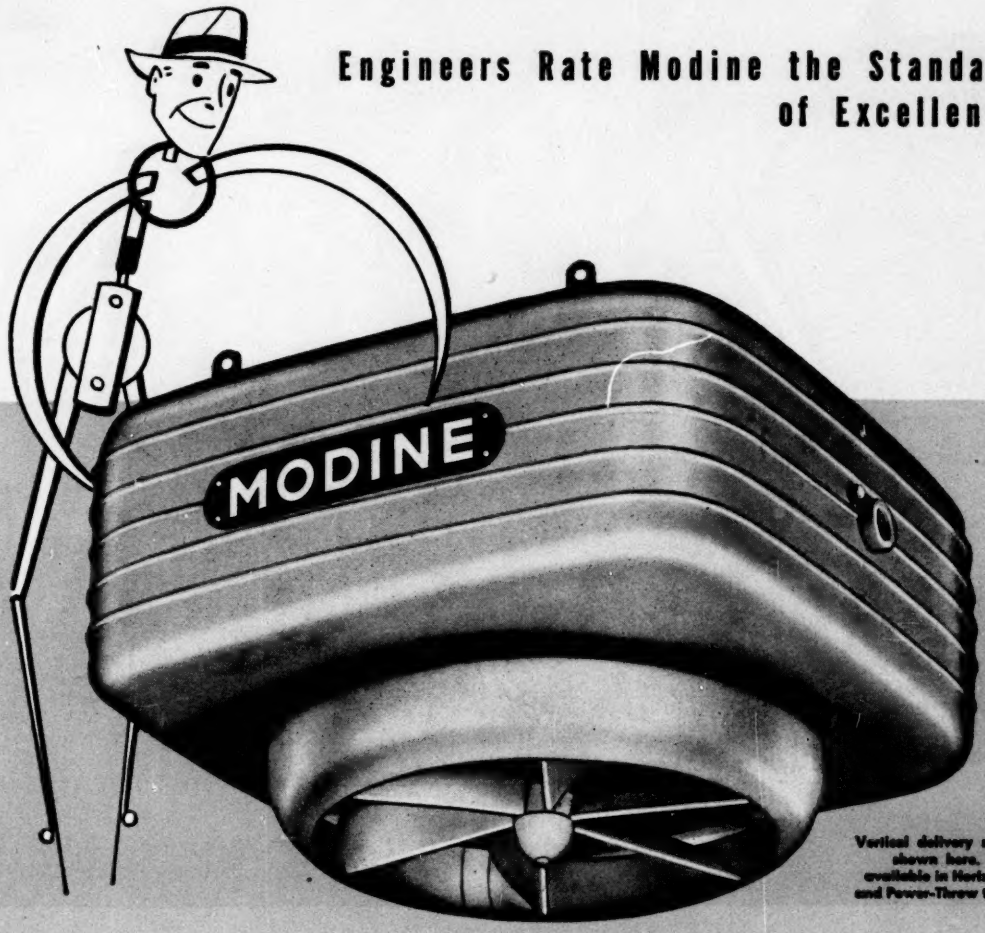
BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Engineers Rate Modine the Standard of Excellence



Vertical delivery model shown here. Also available in Horizontal and Power-Throw types.

Six of many outstanding features that

Modine design promotes mixing of room air and heated air leaving condenser. Result: increased air volume and velocity . . . lower outlet temperatures.

Parker-Bonderizing provides rust-resistance for casings and other sheetmetal parts — anchors paint to steel — preserves the fine finish longer.

Versatile control of air delivery is provided by Cone-Jet, Truncone or Louvre deflectors. You can choose the *right* one for your job at no extra cost.

COMPARE FIRST

...YOU'LL CHOOSE MODINE UNIT HEATERS

Advanced engineering... superb styling... highest grade materials and craftsmanship — all quality hallmarks of Modine Unit Heaters. They're your assurance of *heating performance at its best* — high fuel economy... years of trouble-free service. Built to a standard of excellence — Modine is the choice for unfailing dependability, lower operating and maintenance costs. So whether you need Vertical Delivery Models (illustrated), Horizontals or Power-Throws — *compare first!* Modine Mfg. Co., 1511 De Koven Ave., Racine, Wis.

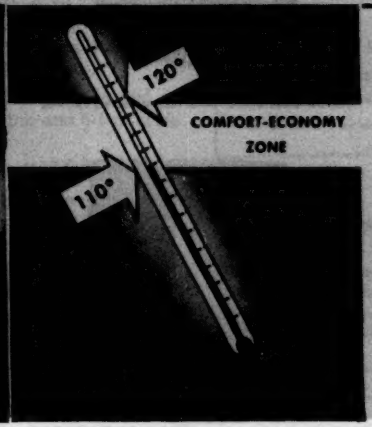
U-1111

Write for Bulletin 149-A, "Modine Unit Heating." Or contact your Modine representative listed in the classified section of your phone book.

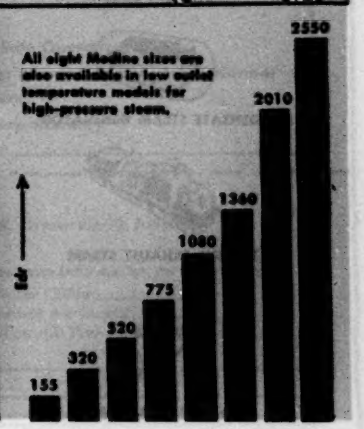
Modine UNIT HEATERS

account for the Modine quality reputation

Cooling sleeve protects motor when fan is not operating — safeguards against condenser radiant heat. A frequent cause of failure on ordinary heaters.



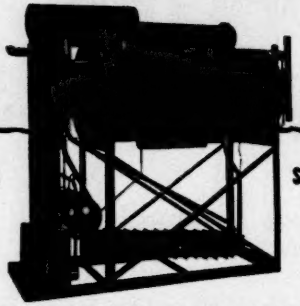
Discharge air temperatures of 110°-120° F. are correctly related to air velocities — assure perfect heating comfort plus lower fuel costs.



Big Modine Vertical Units for big defense plants eliminate expensive ductwork, retain the flexibility necessary for subsequent changes in plant layout.

NEW SERVEL EQUIPMENT AIR-CONDITIONING OR

SERVEL ABSORPTION EQUIPMENT



WATER CHILLER: Rated capacity under standard ASRE conditions—25 tons. Hermetically sealed absorption refrigeration system. Refrigerant, water. Absorbent, lithium bromide. Source of energy, steam. Refrigeration unit operates under a vacuum.

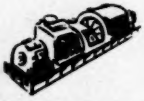
OPERATES ON ANY OF THESE SOURCES OF STEAM

GAS-OPERATED STEAM GENERATOR

INDUSTRIAL BOILER

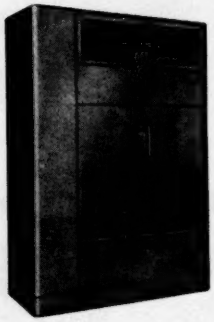
WASTE-HEAT BOILER

CONDENSATE STEAM GENERATOR

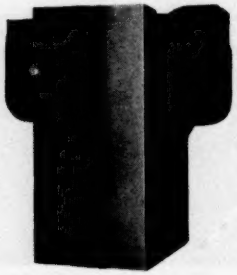


TURBINE EXHAUST STEAM

DISTRICT STEAM LINES



Self-Contained Unit: 5 tons of cooling, heating optional.



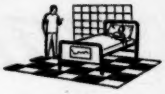
All-Year Air Conditioners. In 3-ton and 5-ton sizes. Cooling and heating. For single or multiple installation.

SUPPLIES CHILLED WATER OR AIR CONDITIONING FOR

INDUSTRIAL PROCESSING

FACTORIES

HOSPITALS



HOTELS

SCHOOLS

OFFICES

STORES

HOMES

SIMPLIFIES ALMOST ANY COOLING APPLICATION

- Light enough to install anywhere
- Runs on steam from any source, any pressure
- Electric-power needs are nominal
- Modulates down to 50% of capacity

NO MATTER how large or how small your cooling or air-conditioning job, the chances are that one of Servel's absorption units can do it better, easier, and at less cost.

If it's chilled water for industrial processing, or air conditioning large buildings that you're interested in, take a look at the new Servel 25-Ton Water Chiller. This latest addition to the Servel line runs on steam from any source, at any pressure. If waste steam or waste heat is available, you can operate on it and save most of the normal costs of fuel.

Electric-power needs are nominal, so you can usually connect to existing wiring. The unit is light, quiet, vibration-free—so much so that you can install it on any floor, without expensive bracing. It supplies chilled water in industrial processes, and—by the use of heat exchangers—will supply air conditioning in any building by simple piping.

For smaller areas, the Servel Self-Contained 5-Ton Air Conditioner, and the 3-ton and 5-ton units provide flexible, low-cost air conditioning. All Servel units have the famous Servel no-moving-parts cooling system. Thus you get long life, low maintenance, quiet, dependable operation.

Get complete information today. And if you'll enclose details of your process cooling or air-conditioning problems, we'll be glad to tell you which unit, or combination of units, our application engineers recommend. Servel, Inc., Evansville 20, Ind.

WHY SERVEL IS YOUR BEST AIR-CONDITIONING BUY

- No Moving Parts in Cooling System To Wear Out
- Low Maintenance Costs
- Hermetically Sealed Circuits
- Long Life
- Completely Safe Operation
- Chilled Water Circuit Operates Under Normal Pump Pressure
- 5-Year Factory Warranty

SEND COUPON FOR MORE INFORMATION

Servel

AIR CONDITIONERS

FOR INDUSTRY • FOR HOME • FOR BUSINESS

Servel, Inc.
Department S-29, Evansville 20, Indiana
Gentlemen:

Please send me more information on the following:

Servel 25-Ton Water Chiller_____
Servel Self-Contained Air Conditioner_____
Servel 3- and 5-Ton *All-Year* Air Conditioners_____

*Name*_____
*Firm*_____
*Address*_____

IF YOUR JOB CAN BE DONE BETTER WITH AIR CONDITIONING OR COOLING, IT CAN BE DONE BEST WITH SERVEL

LESS HORSEPOWER AND

COMPARE ANY FAN OR COIL AGAINST THIS TRANE CHECK LIST

FANS

Feature	Trane	Fan A	Fan B
Chlorinated Rubber Enamel	X		
Formed Inlet Openings	X		
Uninterrupted Duct Collar	X		
Welded Construction (Large Fans)	X		
Lock Seam Construction (Small Fans)	X		
Full Capacity Fan Wheels	X		
Fan Blades as heavy as 7 gauge	X		

COILS

Feature	Trane	Coil A	Coil B
Kinetic Orifice	X		
Plate-Type Fin	X		
Dual-Fin Contact	X		
Mechanical Bond of Fin and Tube	X		
Bushed Tube to Header Joint	X		
Provision for Proper Tube Expansion	X		
Wide Coil Channels—2¼"	X		

THE KINETIC ORIFICE, the patented Trane feature, releases steam in the direction of condensate flow in steam distributing tube coils. Drainage of condensate is accelerated. Stratification and freezing is eliminated.

MANUFACTURING ENGINEERS

BETTER PERFORMANCE

WITH THIS TRANE CENTRAL SYSTEM COMBINATION

You get triple value when you combine Trane Centrifugal Fans and Trane Coils in a central system. You get outstanding products loaded with exclusive features. You get the rugged construction that has made Trane famous. And, you get the added advantages that come only when you combine matched products. *Together Trane Centrifugal Fans and Trane Coils create a central system that produces top performance with less horsepower than any similar combination.*

Here's why:

Thanks to modern design, the average horsepower requirements of Trane Fans is lowest in the industry. Trane Coils with their streamlined bond of tube and flat plate-like fin offer minimum resistance to air flow. Combine a low horsepower fan and a low air friction coil and power demands shrink accordingly. That means you get greater efficiency and lower operating costs.

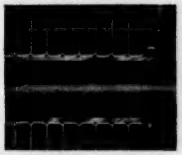
Rugged Construction for Consistent Performance—Then for long life and consistent performance, Trane gives you rugged construction in both products. Compare Trane Fan construction. Part for part, Trane uses metal that is as heavy or heavier than any other manufacturer.

Trane Coils use extra heavy tubing. Coil supports are equally strong. The Trane fin-and-tube construction with its solderless mechanical bond is designed to last a lifetime.

Lower Noise Level Fans—Besides low horsepower and heavier construction, other Trane Fan features include lower noise levels; more accurate fit and tolerance for consistent performance; chlorinated rubber base paint finish to prevent corrosion. Also featured is the uninterrupted collar for easy connection with duct work.

Coil Capacity Increased 15%—First in Trane Coil advantages is the kinetic orifice. This exclusive development in steam distributing tube coils increases capacity as much as 15%. Additional exclusive Trane features—six-step manufacture of fins to insure even heat flow—dual-fin contact that makes the fins an integral part of the tubes and speeds heat transfer—the guide flange assembly that permits expansion of the tubes for longer coil life.

There's similar extra value when you combine other matched products from the complete Trane line of heating, cooling, ventilating and air conditioning equipment. Each product is studded with exclusive features, each offers more rugged construction. And when you combine them in complete systems you get added features such as the less horsepower better performance of Trane Fans and Coils.



DUAL-FIN CONTACT is illustrated in this cutaway section of a Trane Coil. Collar of one fin is extended to next fin to form uninterrupted surface for continuous flow of heat.

ACCURATELY STREAMLINED FAN INLET CONE makes possible even distribution of the air in the fan wheel without noisy turbulence—permits fan to operate at highest efficiency with lowest noise level.

SPLIT FAN HOUSING permits easier installation. On large units, housings can be split on horizontal and vertical plane so fan parts can be moved through small openings and reassembled.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . Toronto
OFFICES IN 80 U.S. and 14 CANADIAN CITIES

OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

Steel saved civilization at Vienna

MODERN history begins with the record of conflict between Christians and Moslems--six centuries of wars that opened with the Crusades and saw the Turks capture Constantinople in 1453.

More than 100,000 Turkish janizaries and cavalry besieged Vienna in 1683. For two months, to quote the diary of an eye witness, "The enemy continued playing their cannon and granadoes. But the city walls were strong, Christian cannon were bigger and more numerous and ammunition more plentiful." Finally came a day when the officer's journal reported, "The enemy did not play their cannon so fast. It was confirmed that they had no great provision of bullets, inasmuch as they shot back not only our bullets, but also pummels of swords and all sorts of iron and stones."

At last a great Christian relief army was assembled. "They made an attack in the best order that ever army did. The enemy, forced always to give back, were put all into confusion. They betook themselves to flight, leaving all their provisions, ammunition, cannons and tents --the greatest part rendered unfit for farther use by our great guns."

Never again did the Turks seriously menace Christendom. Western civilization had been saved once more by its supremacy in the use of iron and steel. To aid our survival America's free private industry is producing steel at the highest rate ever known--and still expanding. The question remains--Will America use enough of this tremendous steel production to guarantee the continued supremacy of Western, Christian civilization?---We believe the answer is yes!

YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

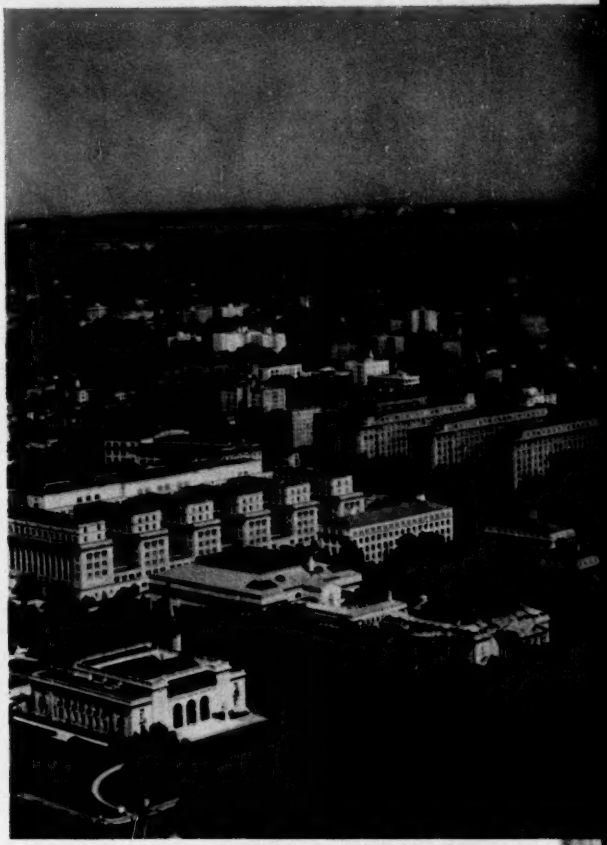
General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap through your regular sources, at the earliest possible moment.

American Blower—a time-honored name in air handling



All air handling equipment is not alike. There's a vast difference in quality, design, quietness, operating costs and efficiency. Look before you buy and you'll buy American Blower products—the accepted quality standard—proved in test after test by buyers.

In Washington, as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Washington area, call American Blower—National 8120. Elsewhere, consult your phone book.

Product of the month

Ceiling-mounted Vertical Unit Heater.

Wall-mounted Venturafin Unit Heater.

Unit Heaters save fuel

In any plant or business, to insure customer satisfaction and add to your profits, recommend and install American Blower Unit Heaters.

American Blower Unit Heaters, for steam and hot water heating, are available in vertical and horizontal models, for wall and ceiling installations. All carry Certified Ratings, contain heavy-duty coils and are sound-rated.

Modern, die-formed steel casings completely enclose all moving parts, an important safety factor. Unobstructed outlets allow maximum heat diffusion throughout the entire working area, assuring comfortable final temperatures.

For complete information, call the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

"Let's look in this window, Grandma... the sidewalk's dry"

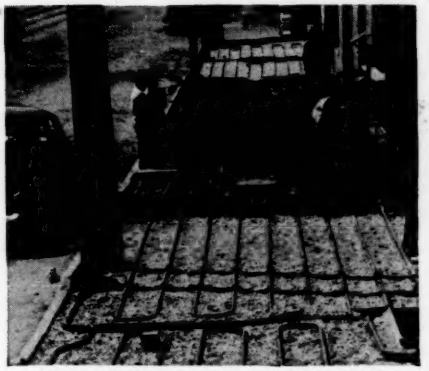
Steel Pipe is first choice for snow melting

There's an old saying that "business goes where it is invited and stays where it is well treated." Yes, the considerate ways of doing business are also the profitable ways! Successful business men know that thoughtfulness for the comfort and convenience of the customer helps ring cash registers as much as the price tag or quality of merchandise.

So, high on the list that "wins friends and influences people", along with such known sales builders as air conditioning, adequate parking, good lighting, and modern rest rooms, is *sidewalk and parking area snow melting!*

Steel Pipe is first choice for these installations. You see, Steel Pipe, as the hot water circulating system, has all the desirable working characteristics required for a successful snow melting system. That means durability, formability, weldability and suitability . . . plus maximum economy!

A free 48-page color booklet "Radiant Panel Heating with Steel Pipe" is now available to you. Write for a copy.



A typical sidewalk snow melting installation showing an effective layout of steel pipe coils.

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.

FRESH AIR "MADE TO ORDER"

Saves money!

Saves critical materials!

Make DOREX AIR RECOVERY part of your air conditioning or heating installation

Here's what we mean by "made-to-order" fresh air:

To maintain air quality, your ventilation system must continually bring in air from the outside. You have to heat or cool this air—which costs money. But when Dorex Air Recovery is part of the system, only about one-third as much outside air need be taken in. Dorex supplies the rest by making fresh air "to order" from the used air that has already been conditioned.

This is done simply by passing the used air through Dorex C Cells—containers of activated carbon that extract all odorous and gaseous impurities. The air you have already paid good money to heat or cool comes out just as fresh and usable as air from the outside.

Now, let's look closer at savings. You save critical materials because substantially less heating and cooling equipment is required. You save money because you have far less air to condition. On the basis of 20 years' experience and over 7,000 Dorex installations, you can safely figure a $400 saving on original equipment for every $100 invested in Dorex Air Recovery . . . and a $4 saving in operating costs for every $1 spent for Dorex maintenance.

Get the full story of Dorex Air Recovery. Mail the coupon today.

DOREX
Air Recovery

W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

TRADE MARK "DOREX" REG. U. S. PAT. OFF

W. B. CONNOR ENGINEERING CORP.
Dept. B9, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery

Name .....

Position .....

Company .....

Street .....

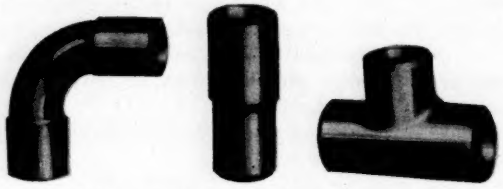
City ..... Zone ..... State .....

look! ...it must be a Streamline® fitting!

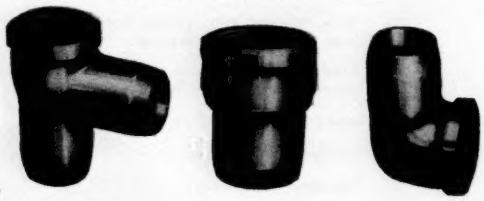
Streamline® solder type fittings are really made to last . . . and they'll make a neater, quicker installation

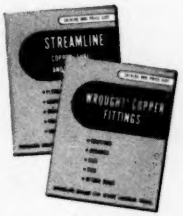
If Cleopatra's plumber had used STREAMLINE fittings we wouldn't be surprised if they would still be in pretty serviceable condition today. For STREAMLINE solder type fittings are really made to last. They cannot rust, they're not loosened by vibration and they're virtually free from clogging. STREAMLINE fittings assure a snug-fitting, tightly joined system that tests leak-proof on the first try and doesn't develop leaks later. When you install STREAMLINE fittings, you can be sure you're installing a permanently reliable conducting system whether for plumbing, heating, air conditioning or industrial use.

And here's something else . . . because of their design, precision manufacture and accurate dimensions, STREAMLINE solder type fittings can be installed quickly and the uniform depth of the solder joints makes it easy to compute the exact length of tubing needed. Thus STREAMLINE fittings not only assure a permanent installation, they also reduce job cost and increase the number of installations a contractor can handle.



STREAMLINE wrought and cast fittings are available in a complete range of standard sizes.





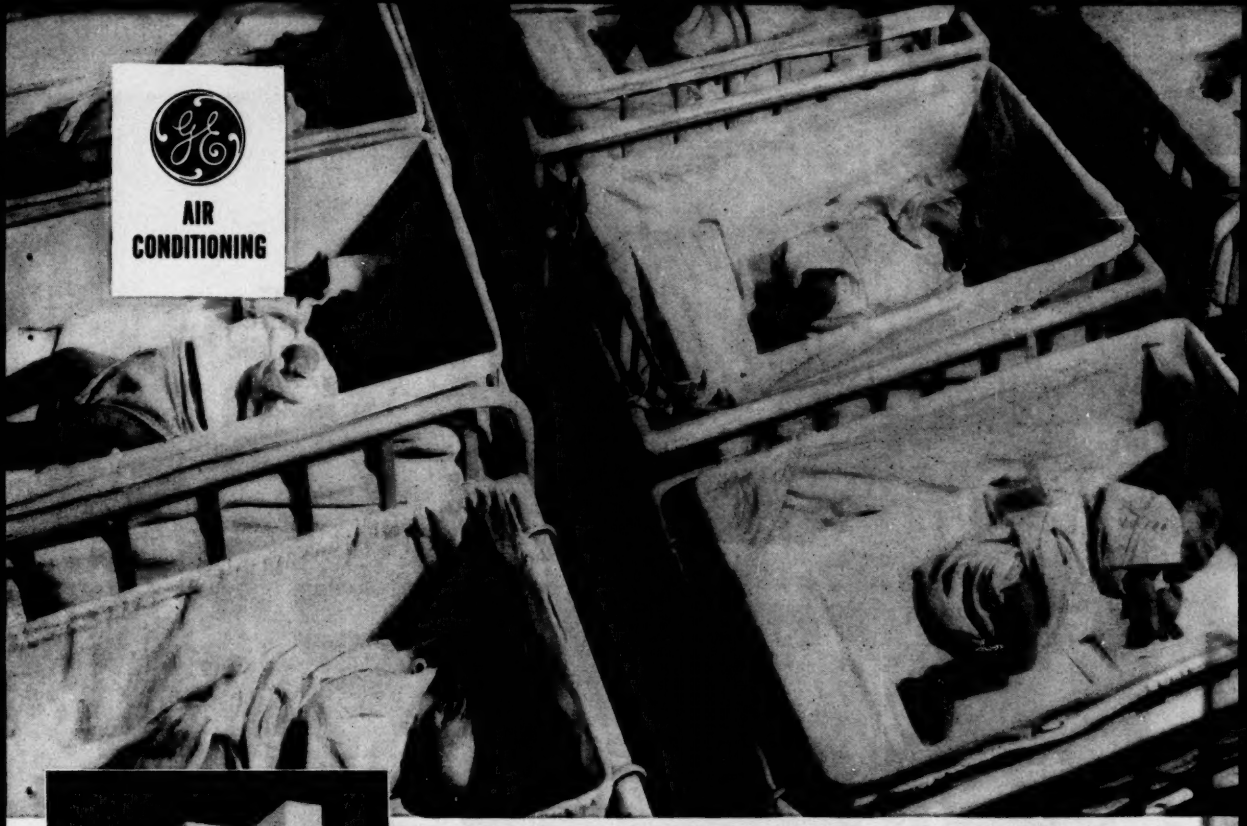
See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

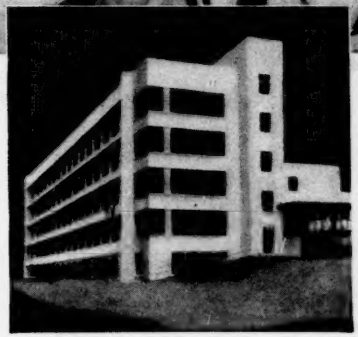
63

MUELLER BRASS CO. STREAMLINE PRODUCTS

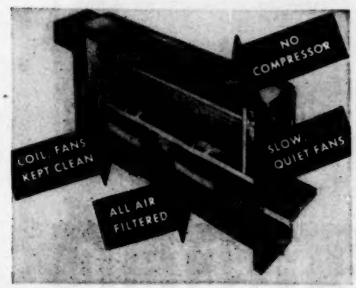
MUELLER BRASS CO. PORT HURON 2, MICHIGAN

AIR CONDITIONING





Year 'round comfort for entire Navarro County Hospital, Corsicana, Texas, will be provided by 111 G-E room units, plus G-E refrigeration machines and central plant conditioners. Architect: W. G. Clarkson & Company, Fort Worth; Consulting engineer: Leonard Kanto, Fort Worth; General contractor: Campbell & Kay, Tyler; Air Conditioning contractor: Beals Plumbing & Heating Co., Fort Worth.



All air is filtered by G-E room units, maintaining capacity by protecting coils. Reduces cleaning, too. Units can be installed in wall or in handsome 9-inch cabinet. Chilled water for cooling and warm water for heating supplied through pipes from remote central plant.

New-born babies get constant temperature and humidity control in nurseries of such G. E.-Air Conditioned hospitals as Wesley Memorial, Wichita, Kans.; State Sanatorium, Oakdale, Iowa. Fresh air is constantly circulated. Nurseries can be heated at the same time other parts of building are being cooled.

G. E. Helps Hospitals Cut Air Conditioning Costs

Budget-minded hospital men select flexible G-E Personal Weather Control for a nursery or a whole building

To help babies get a fine start—to give *all* patients a refreshing atmosphere—to improve working conditions for doctors and nurses—more and more hospitals choose G-E Personal Weather Control.

G. E.'S FLEXIBILITY means better results at lower costs. In the new Navarro County Hospital in Corsicana, Texas, for example, ventilation air will be supplied through grilles separate from the room unit. This independent fresh air system gives better humidity control, cuts power costs by greater use of outside air for cooling.

TO MEET THE NURSERY'S SPECIAL NEEDS, 100% outside air will be used in its central system. Even drug storage rooms will get limited, low-cost cooling. For cleanliness, all fresh air as well as room air will be filtered.

WRITE NOW for free data to General Electric Company, Air Conditioning Division, Sec. HV-3, Bloomfield, N. J. And ask, too, about G. E.'s sanitary water coolers for convenient drinking water supply at minimum expense.

SEE OUR CATALOG IN SWEET'S

You can put your confidence in—

GENERAL ELECTRIC

HITS A HIGH NOTE IN PERFORMANCE

The secret of *outstanding* symphony performance can be traced to the skill of the conductor. The talent of each individual musician must be coordinated with all the others for perfect balance and exact timing.

In the design and manufacture of Emerson-Electric Motors, there is no secret reason for their *outstanding* performance. Specifications require that each component part be soundly constructed, and that all the parts must operate together, harmoniously, to give efficient, exacting service.

Many of America's leading appliances and products are powered with Emerson-Electric Motors. Their manufacturers have discovered that the smooth operation of Emerson-Electric Motors is an *outstanding* factor in building sales. Your inquiry for full information, without obligation, is invited. Write today.

EMERSON-ELECTRIC'S unique

Twin-gineering

SERVICE

solves your power problems

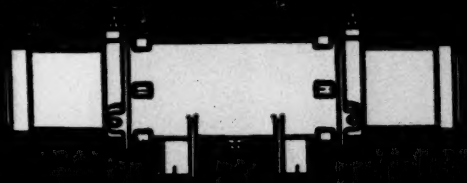
Emerson-Electric Engineers are eager to collaborate with your own staff in designing and providing the proper motor application to your new or improved appliance or equipment. "TWIN-GINEERING" can save you costly engineering "back-tracking," and may suggest short cuts or improvements of great competitive benefit to your product. Write today for Free bulletin No. 154.

THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo. 22

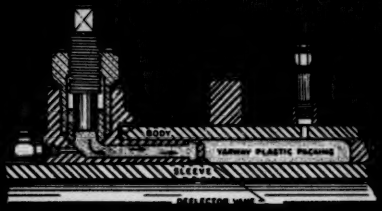
EMERSON Emerson Electric **ELECTRIC**

MOTORS • FANS APPLIANCES

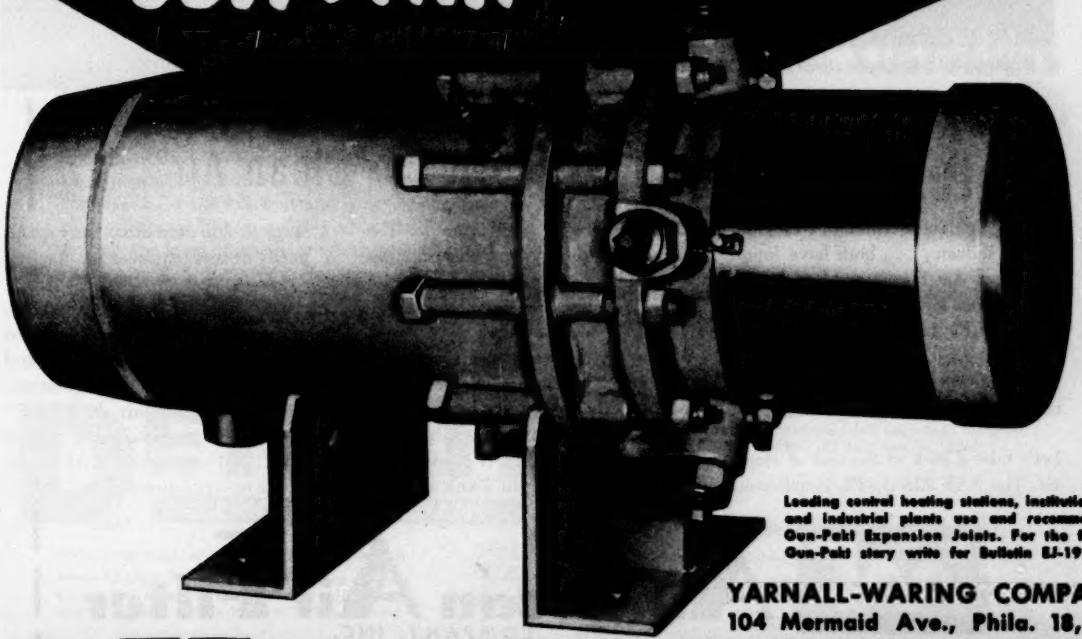
YOU NEED FEWER JOINTS



AND LESS MAINTENANCE



GUN-PAKT



Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
104 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

clean air costs less than dust!

AAF Electro-PL installation cleans air efficiently with low maintenance cost.

SIZE IS NOT A FACTOR

. . . for a plant to profit by "Clean Air"

SMALL manufacturer . . . or giant of industry . . . both have found American Air Filters a sound investment. Clean air quickly demonstrates its value by improving efficiency in shop and office. People work better—machines work better—maintenance costs go down.

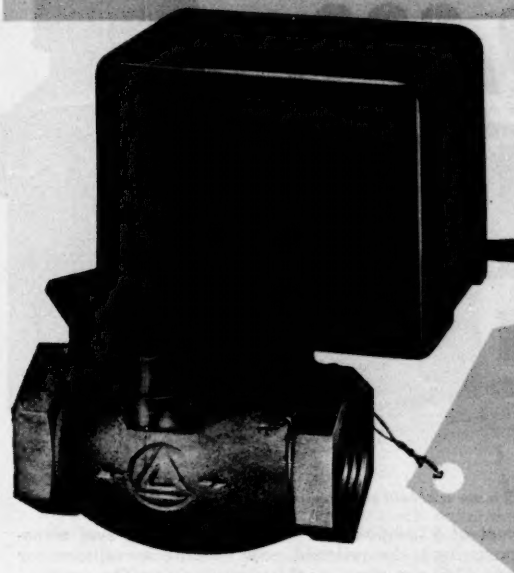
Let's take a look at the cost of clean air. The AAF Electro-PL installation shown here is a good example. The Electro-PL is a dry-type, electronic air filter of high efficiency . . . with special design features that simplify maintenance. It was selected by Upson-Walton for two reasons: reasonable cost, and performance characteristics that met their special requirements. The Electro-PL is exceptionally versatile in application, as it is available in units for Straight Bank or "V" arrangement to meet almost any space, capacity or cost requirement.

Electro-PL is only one of many types of air cleaning products manufactured by AAF. If you want a correct and economical answer to these questions • How much *clean* air do I need? • How *clean?* • How much will it cost? . . . call your nearby AAF representative or write direct to us.

AAF **American Air Filter**
COMPANY, INC.

294 Central Ave., Louisville 8, Kentucky • In Canada: Darling Brothers, Ltd., Montreal, P. Q.

demand DETROIT CERTIFIED



This Exclusive Combination of DETROIT Features

V-579 "BI-FLEX" GAS VALVE

- ★ Quiet operation—no click, no hum. An ideal replacement for noisy valves.
- ★ Rugged, compact design—easy to service.
- ★ Inexpensive.
- ★ Adaptable to all gases.
- ★ "Bi-flex" motor operated—low voltage.
- ★ Temperature and voltage compensation.
- ★ Snap-action opening and positive closing.
- ★ ½ inch to 1¼ inch sizes.

The exclusive features of the V-579 "Bi-flex" Gas Valve prove that you get more for your money when you deal with DETROIT. You can always count on giving your customers a better job when you install any DETROIT control. DETROIT controls are designed and built to fill your customers' needs—to give real economy and reliability through years of trouble-free service. The V-579, for example, at low initial cost, gives your customers an exclusive combination of outstanding features which provide new standards for the efficient and quiet operation of modern gas burning equipment. And that's exactly the kind of operation that pays off with more comfort for the user, more sales and profits for you. So take advantage of this extra value—insist that your source of supply furnish DETROIT controls with all your heating equipment. Write for Bulletin No. 229.

Means More Comfort for your Customers

More Profits for You!

No. 411 Thermostat—A sensitive and accurate *Timed Cycling* thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545.

DETROIT LUBRICATOR COMPANY

5900 TRUMBULL AVE., DETROIT 8, MICHIGAN

Division of American Radiator & Standard Sanitary corporation

RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg.

DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

HOW DRAVO *Counterflo* HEATERS

*helped a large eastern railroad**

save $159,000.

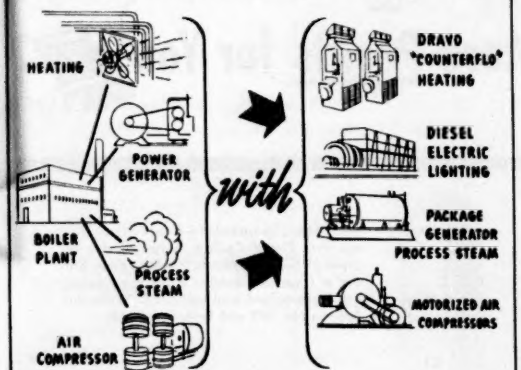
IN ONE YEAR

**Customer's name withheld on request.*

When a large eastern railroad dieselized its locomotive fleet, it not only reduced its road operating expenses, but found substantial savings in an improved method of providing heat, light and process steam for its reconverted shops.

By replacing the old steam power plant which had supplied heat, light, power and compressed air at a cost of $208,600 per year (not counting fuel transportation), the railroad now obtains its utilities for $48,676 per year at this installation. The savings offset the total investment in new equipment in ten months! Savings for the second year of operation amount to nearly $160,000.

HERE'S HOW...IT WAS DONE
THIS RAILROAD REPLACED...



DRAVO HEATERS PLAY MAJOR PART IN THESE SAVINGS

These are the advantages the railroad gained through the use of Dravo "Counterflo" Heaters:

- . . . low initial cost . . . savings up to 60% on installation
- . . . concentration of heat at working level
- . . . 150 foot air throw . . . no duct work required
- . . . flexibility . . . units can be mounted in any position, floor, wall or ceiling
- . . . burn gas or oil . . . readily converted . . . low fuel consumption
- . . . automatic control . . . on-off or modulating controls
- . . . long service life, low maintenance . . . stainless steel combustion chamber
- . . . mobility: can be moved easily to any location

Versatile Dravo Heaters are used in nearly every type of industrial installation.

"Counterflo" Heaters are ideal for commercial and industrial use in foundries . . . warehouses . . . machine shops . . . stores . . . schools . . . churches . . . process industries . . . any many others. Why not look into the possibilities of Dravo Heaters for your heating and ventilating needs? Write today for Bulletin No. OP-526-68

DRAVO CORPORATION

HEATING DEPARTMENT, DRAVO BUILDING, PITTSBURGH 22, PA.

PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON

Sales Representatives in Principal Cities

DRAVO

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec

EXPORT ASSOCIATES, LYNCH, WILDE & CO., WASHINGTON 9, D. C.

BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better

There are just two steps to closing more business

THE FIRST STEP IS—*use this coupon*

Just fill it in and mail it

We will know this is your request for a Brunner factory representative to stop in and go over the reasons why Brunner dealers find it easier to close business.

Name

Company

Address

City and State

With all the facts fresh in mind you will recognize the second step—recommend and install Brunner's from now on. With 69 models comprising a complete range of commercial capacities and types, a dependable source of supply and a known product with ready acceptance by your customers, selling obstacles are removed and you are on the way to bigger business. We will be looking for the coupon.

BRUNNER MANUFACTURING COMPANY
Utica 1, New York, U. S. A.

REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS 1/6 HP. to 75 HP.

BRUNNER **AIR CONDITIONING**
Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.

Now More Than Ever

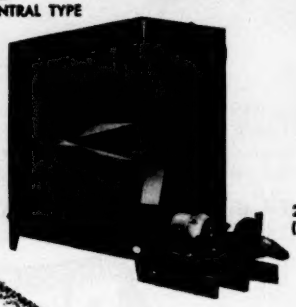
It's Curtis for PROFITS

Because Most Installations are Within the Curtis Range — 2 through 40 Tons

10 and 15 Ton
Complete CENTRAL TYPE

2 through 8 Ton PACKAGED UNITS
(Shipped to you completely assembled)

Evaporative Condensers, Cooling Towers and Air Handling Units



With these units, you can handle any AIR CONDITIONING — REFRIGERATION or AIR MOVING JOB within this range — and when the job is sold, it STAYS SOLD because the QUALITY IS THERE. No corners have been cut in the manufacture of Curtis equipment — pound for pound, it's the best buy in the industry.

VISIT OUR EXHIBIT . . . 7th All-Industry Refrigeration and Air Conditioning Exposition. November 5-8, 1951. Booth Nos. 431-435-436-442.

¼ H.P. through 40 H.P.
Condensing Units.

Advertising Support A-Plenty

SATURDAY EVENING POST

TIME

NEWSWEEK

and many special consumer publications are pre-selling Curtis equipment to your prospects.

Curtis

97 Years of Successful Manufacturing

Curtis REFRIGERATION AIR CONDITIONING COMMERCIAL

NOTE — A Curtis franchise may be open in your area.

Pin this to your letterhead and mail

CURTIS REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1999 Kienlen Avenue
St. Louis 20, Missouri

I am interested in Curtis line.
Please send me complete information.

McQuay's NEW RIPPLE FIN COILS

. . . for heat transfer surface of higher efficiency and more durability!

Now, the new, improved Ripple-Fin makes McQuay Heating (blast) Coils even more rugged and efficient. Consider these advantages of the new Ripple-Fin Coil construction:

Produce a turbulent air flow pattern . . . closer and longer contact between the air stream and the coil surface, preventing air by-pass and producing faster heat transfer.

Offer greater heat transfer surface.

Give higher flexible strength with minimum air friction and cleaner operation.

Copper tube headers provide inherent flexibility to accommodate unequal contraction and expansion.

Hydraulic expansion of all tubes into fins having wide smooth collars assures permanent mechanical bond.

Intruded tube holes allow headers to flex and absorb uneven stresses.

Available in a wide variety of styles and sizes. Both standard and special coils for steam, hot water, cold water, brine, direct expansion, refrigerant condensing, and other applications. Write, McQuay, Inc., 1619 Broadway St. N.E., Minneapolis 13, Minn. Representatives in all principal cities.

McQuay INC.

HEATING • AIR CONDITIONING • REFRIGERATION

NOW 3 GREAT PIPE INSULATIONS

Amocel

joins Unibestos in the UNARCO line of asbestos pipe insulations

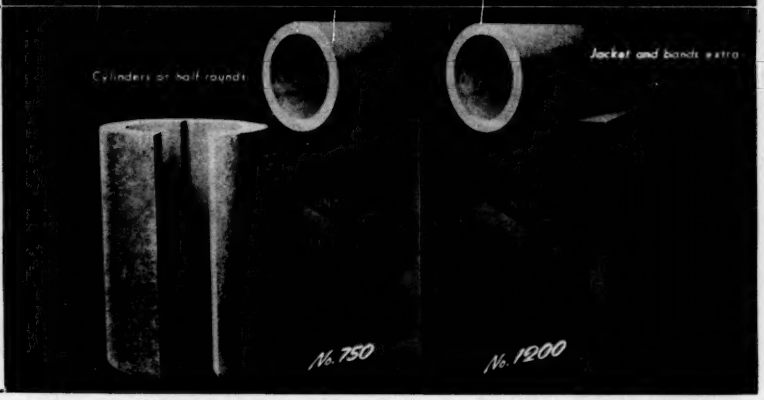
...up to 650°F.

Answering the demand for a jacketed pipe insulation for use in the lower heat ranges, UNARCO now offers Amocel — for temperatures up to 650°F. Like Unibestos, Amocel is made of Amosite asbestos fibers bonded with an inorganic binder. For pipe sizes from ½" through 12", in Standard thickness only. Light in weight. Highly efficient. Durable.

UNIBESTOS
...up to 750°F.

UNIBESTOS
...up to 1200°F.

2 GREAT PIPE INSULATIONS — Unibestos No. 750 and No. 1200 — long have been America's outstanding insulations in their respective temperature ranges. Regular production for pipe sizes from ½" through 24" in popular thicknesses through 4". Other thicknesses and sizes available on order.



We want you to have our Catalog — It gives you complete information on Amocel and Unibestos Pipe Insulations; Unibestos Insulating Block; Cements and Finishes; Flexible Insulations; Metal Mesh Blankets; Tailored-to-Fit Insulations; Asbestos Packings and Gaskets; Asbestos Textile Products . . . Just drop us a line today requesting that we send you UNARCO Catalog No. 76-109.

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. 817A • 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

Bundyweld Tubing shines in better radiant heating systems

Shines in *on-the-site* fabrication, too.

Bundyweld is the only tubing double-walled from a single strip, with an exclusive beveled edge. It is copper-brazed, perfectly bonded through 360° of wall contact, into a solid-walled tube with thinner yet stronger walls. It is held to close tolerances.

Scale-free and smooth inside and out, Bundyweld arrives at the building site in twenty-foot lengths, with one end expanded if specified.

One man quickly bends grids on a simple wood or metal form and joins them by soft or silver soldering. Two men easily position the lightweight, rigid, joined grids.

Bundyweld shines, too, in your radiant heating systems. It's extra sturdy with a margin of safety against leaks or bursts under normal pressure. Its thinner wall radiates heat faster for more effective performance.

You can already see that Bundyweld offers many unique performance and fabrication advantages that mean time, work, and money saved. But there are more. Check *Sweet's Architectural File* for details. Or write us. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

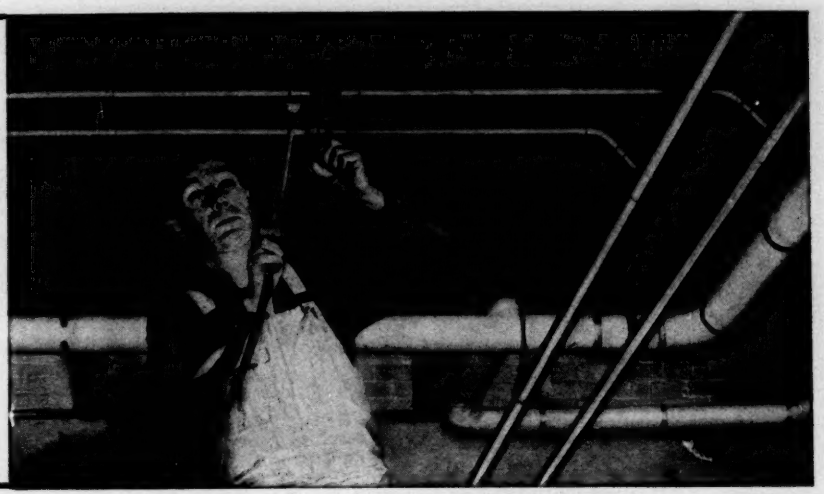
passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

HIGH

For domestic hot and cold water lines you can still use copper — non-rusting, highly resistant to corrosion!



LOW

The use of copper for underground service lines—another place where you need this hardy metal—is not prohibited by government regulations!

...Chase Copper Water Tube is best!

Made from commercially pure copper, Chase Copper Water Tube is ideal for hot and cold water lines and underground piping.

Chase Copper Water Tube, Type L, hard temper, in 20 ft. lengths and solder-joint fittings are especially adapted for use in new construction. For replacing old rusted-out piping, Chase Copper Water Tube, Type K, soft temper, comes in long 40 and 60 ft. coils that can be snaked behind walls and under flooring.

For underground installations use Type K, soft temper, Chase Copper Water Tube. It is ductile; can be bent around obstructions; moves with the earth until the fill settles. Long lengths up to 100 ft. in coils reduce the number of flared fitting connections to a minimum.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

CHASE 75th ANNIVERSARY 1876 1951

• *The Nation's Headquarters for Brass & Copper*

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

nyb

Investigate

STEELFIN!

It has everything you want in Heavy Duty Heat Surface

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS FOR CONTINUOUS HEAT SERVICE UP TO 150 POUNDS STEAM PRESSURE

The rugged arc welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals, avoids their expansion-contraction faults, yet has the same BTU efficiency.

Originated in 1922, it has an enviable record of dependable performance.

●

WRITE FOR YOUR COPY OF BULLETIN 514, ALSO 492 WHICH GIVES ENGINEERING DETAILS.

nyb **THE NEW YORK BLOWER COMPANY**

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

Who's thinking of you?

The men in our shops know what it's like to install and service air conditioning. They know the kind of jobs you run into. That's why these engineers of ours have tried to make your job just as easy as possible.

Take our System Weathermaker*, for instance. We've built it with you in mind.

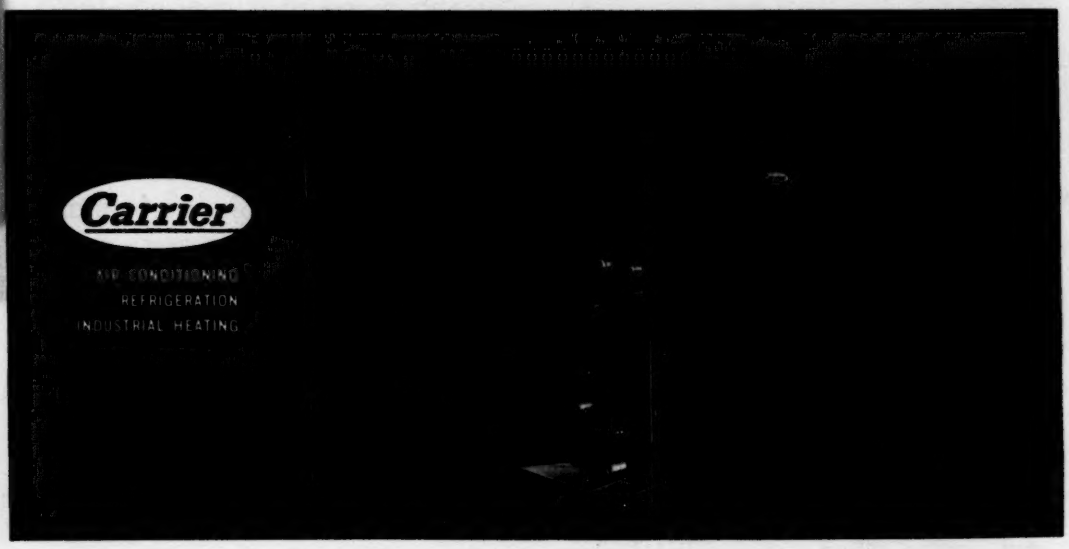
It's built in sections. That makes it easier to handle. And more convenient to install, horizontally or vertically. Fan, cooling coil, heating coil, by-pass and filter sections—they can all be arranged as you like. You can make your coil connections from either end.

Then, too, we've designed new fans and put the coil on an incline. This puts more coil surface to work and we can cut down on the size and weight of the unit without cutting down on the job it does. So the System Weathermaker weighs less. That's important to the man who has space or structural limits.

We've made this Weathermaker easy to service, too. You can reach all sections without any trouble. There's no sweating—our insulation sees to that. And rubber paint fights off rust.

There's a Carrier Weathermaker for every air conditioning job. The cfm range goes from 1000 to 16,400 in single units. Want more information? Look in your Classified Directory for the Carrier dealer nearest you, or write Carrier Corporation, Syracuse 1, New York.

*Reg. U. S. Pat. Off.



This is the Carrier System Weathermaker, 1000 to 16,400 cfm in single units. Available also in Model 39T horizontal type.

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

...to be sure of sound welds and fast assembly

L

TO MARK PROGRESS

Keeping welding costs down to a minimum and erection schedules on time... these are important advantages you can assure to any piping job by installing Ladish Controlled Quality fittings. Metallurgical controls over materials and methods provide an assurance of uniform weldability in every Ladish fitting... and thorough inspection to rigid standards of physical dimensions and geometric accuracy assures fast piping assembly.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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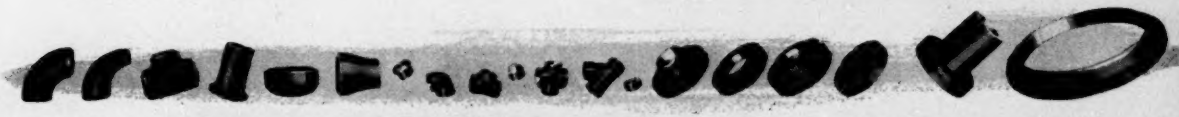


When a thermometer measures your reputation . . .

Hoover®

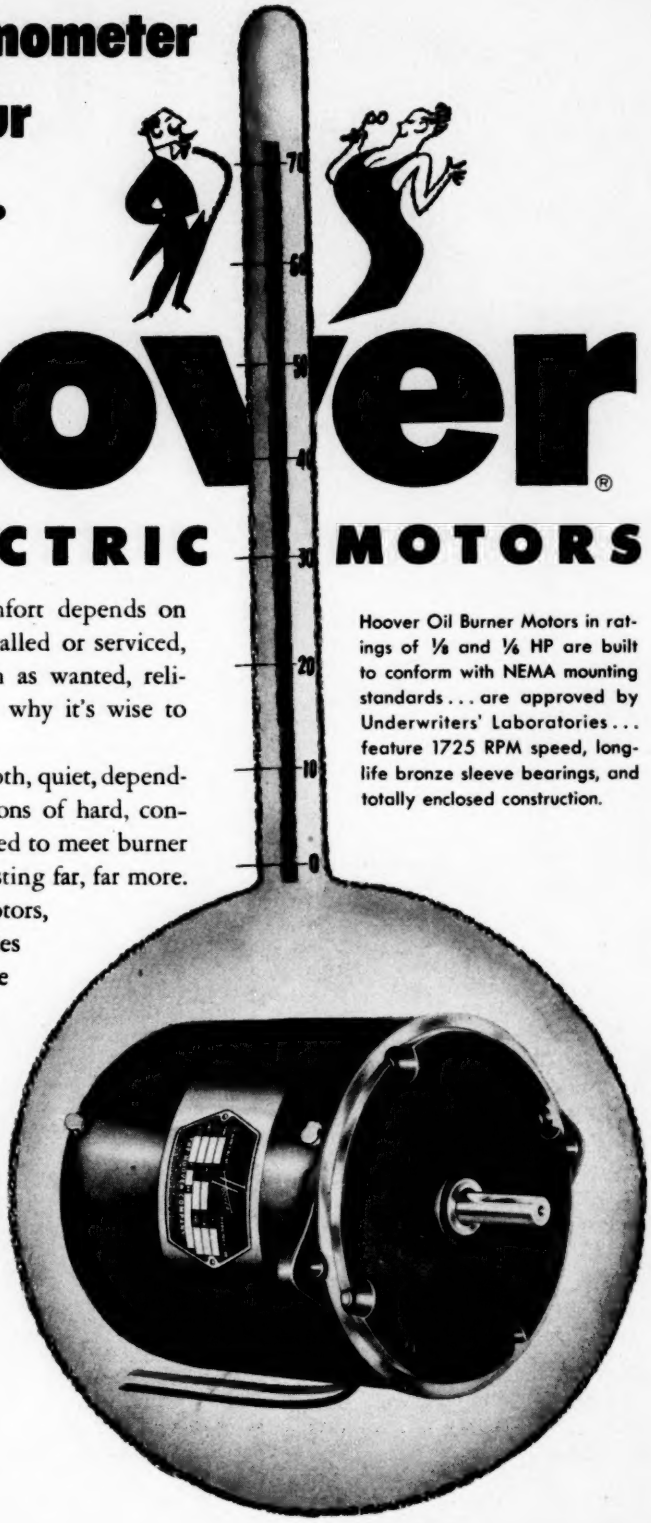
ELECTRIC MOTORS

When a customer's cold-weather comfort depends on an oil burner you have specified, installed or serviced, that burner had better deliver warmth as wanted, reliably and without breakdown! That's why it's wise to rely on Hoover Motors!

Hoover oil burner motors give smooth, quiet, dependable performance, even under conditions of hard, continuous use. They're specifically designed to meet burner needs, and they're built like motors costing far, far more.

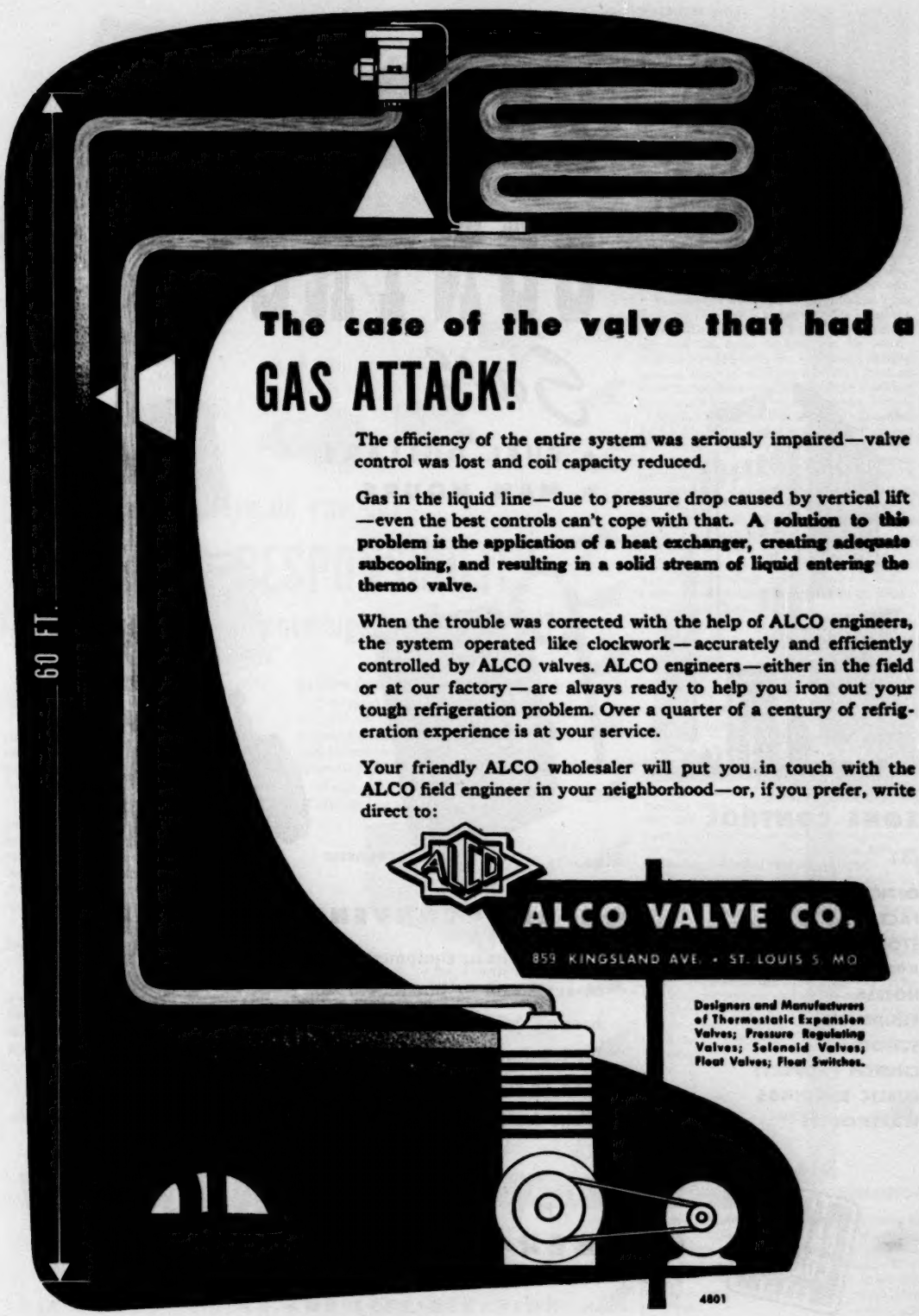
There are many other Hoover Motors, too—for many other applications besides oil burners. In fact, if you sell or service ANY motor-powered equipment, you'll undoubtedly find a Hoover Motor to fit your needs...satisfy your customers...to help YOUR reputation measure up!

Hoover Oil Burner Motors in ratings of 1/8 and 1/6 HP are built to conform with NEMA mounting standards . . . are approved by Underwriters' Laboratories . . . feature 1725 RPM speed, long-life bronze sleeve bearings, and totally enclosed construction.



Write today for complete information—on oil burner motors or on other motors for other purposes.

THE HOOVER COMPANY
Kingston-Conley Division
68 Brook Avenue
North Plainfield, New Jersey



The case of the valve that had a GAS ATTACK!

The efficiency of the entire system was seriously impaired—valve control was lost and coil capacity reduced.

Gas in the liquid line—due to pressure drop caused by vertical lift—even the best controls can't cope with that. **A solution to this problem is the application of a heat exchanger, creating adequate subcooling, and resulting in a solid stream of liquid entering the thermo valve.**

When the trouble was corrected with the help of ALCO engineers, the system operated like clockwork—accurately and efficiently controlled by ALCO valves. ALCO engineers—either in the field or at our factory—are always ready to help you iron out your tough refrigeration problem. Over a quarter of a century of refrigeration experience is at your service.

Your friendly ALCO wholesaler will put you in touch with the ALCO field engineer in your neighborhood—or, if you prefer, write direct to:

ALCO VALVE CO.

859 KINGSLAND AVE. • ST. LOUIS 5, MO

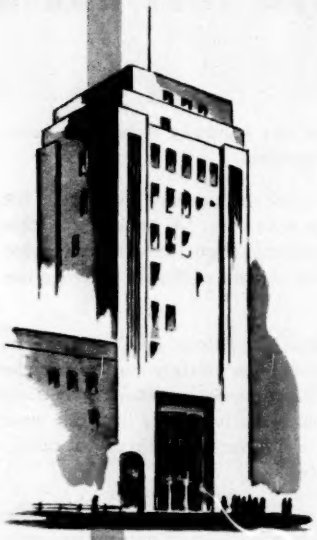
Designers and Manufacturers of Thermostatic Expansion Valves; Pressure Regulating Valves; Solenoid Valves; Float Valves; Float Switches.

4801

BARBER COLMAN

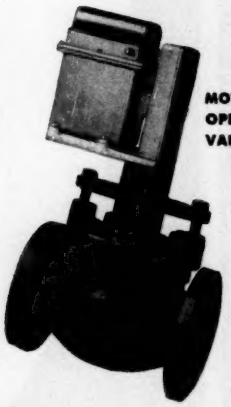
ZONE CONTROLS *Save*

- **FUEL DOLLARS**
- **MAN HOURS**



ROOM THERMOSTAT

ECONOSTAT



MOTOR-OPERATED VALVE

ZONE CONTROL *for*

OFFICE BUILDINGS
FACTORIES
STORES
APARTMENTS
HOTELS
RESIDENCES
SCHOOLS
CHURCH PROPERTY
PUBLIC BUILDINGS
WAREHOUSES

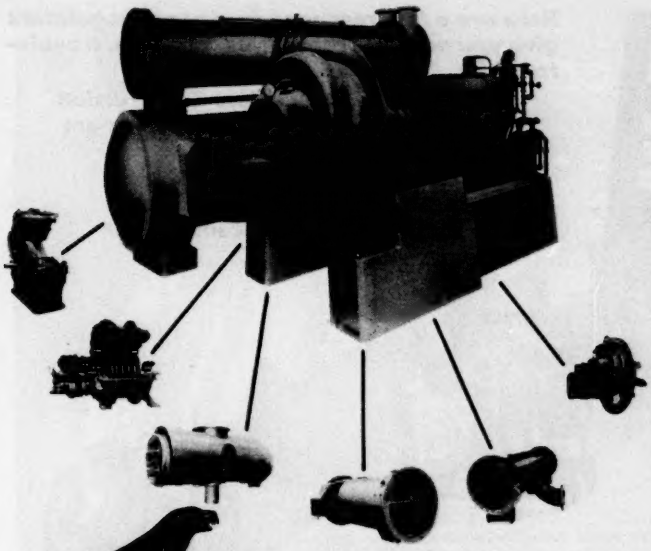
COMFORT • CONVENIENCE • ECONOMY

Barber-Colman equipment is adaptable to any steam or hot water heating system, and can be engineered for maximum performance in any kind or size of building. Write for bulletin F 3718-1.

NATION-WIDE SALES AND ENGINEERING SERVICE

BARBER COLMAN

BARBER-COLMAN COMPANY
1224 ROCK STREET • ROCKFORD, ILLINOIS



Where do you get

UNDIVIDED RESPONSIBILITY

in an installation of centrifugal refrigeration?

Worthington will "wrap up a package".

Unlike other manufacturers of air conditioning and refrigeration equipment, Worthington *makes*—not just assembles—all the major components for each installation.

Compressor, condenser, cooler and such drive equipment as steam turbines, steam condensers, motors, and step-up gears—are all made in Worthington's own plant—each carefully designed for balanced operation with its companion components.

So the builder and owner can place full responsibility on the one supplier —Worthington.

Worthington centrifugal systems are used with most refrigerants and for any process—chilling water, brine, chemicals, lubricating oils—for temperatures as low as minus 160 F, capacities from 150 to 2600 tons.

A typical Worthington compressor feature is the arrangement of the volute passages and impellers to counterbalance the radial and axial thrusts, respectively, in the various stages.

Write for Bulletin C-1100-B14 on Worthington centrifugal refrigeration.

Worthington room conditioners for both heating and cooling are built to operate with chilled water or direct expansion cooling, capacities from 350 to 600 cfm for under-window installation.

PACKAGE UNITS SELECTED TO COOL HUGE OFFICE BUILDING

This is an excellent example of how Worthington's complete line makes it possible to select exactly right equipment.

The new office building at 488 Madison Avenue, New York—home of many famous magazines and large industrial firms—is air conditioned primarily by package units, assisted by a Freon-12 reciprocating system with chilled water and steam coils.

Purpose of using package units in a big building like this is to provide for a variety of conditions imposed by both the building and the type of tenants: air conditioning needed only on top floors during certain seasons, difference in sun load on various sections, certain tenants working late hours but only with skeleton forces.

Second through 20th floors are handled by 38 Worthington 20 and 25 ton Package Air Conditioners, two per floor. Basement, first floor and top three floors are handled by two Worthington 75-ton Freon-12 compressors complete with condensers, pumps, water coolers and five central station units with chilled water and steam coils. Total capacity is 1050 tons.

Builders and owners: Uris Bros. Consulting engineer: Henry Oehrig. Air conditioning contractor: Raisler Corp. Architects: Emery Roth & Sons. All of New York.

RICE HOTEL MULTIPLIES COMFORT-COOLING WITHOUT REQUIRING MORE ROOM

Last year, Houston's Rice Hotel completed air conditioning its entire building, including a thousand guest rooms, dining rooms and meeting rooms, by installing three Worthington 600-ton centrifugal chilled water systems.

This equipment, utilizing Freon-11, replaced ammonia refrigeration equipment having a capacity of 350 tons, yet occupies no more space than formerly.

Worthington equipment was selected primarily because Worthington could provide 100% equipment of its own make. The compressors are driven by Worthington steam turbines and steam condensers.

Engineer: Reg. F. Taylor. Mechanical Contractor: Charles G. Heyne & Co. Architect: Kenneth Franzheim. All of Houston.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

INVESTIGATE

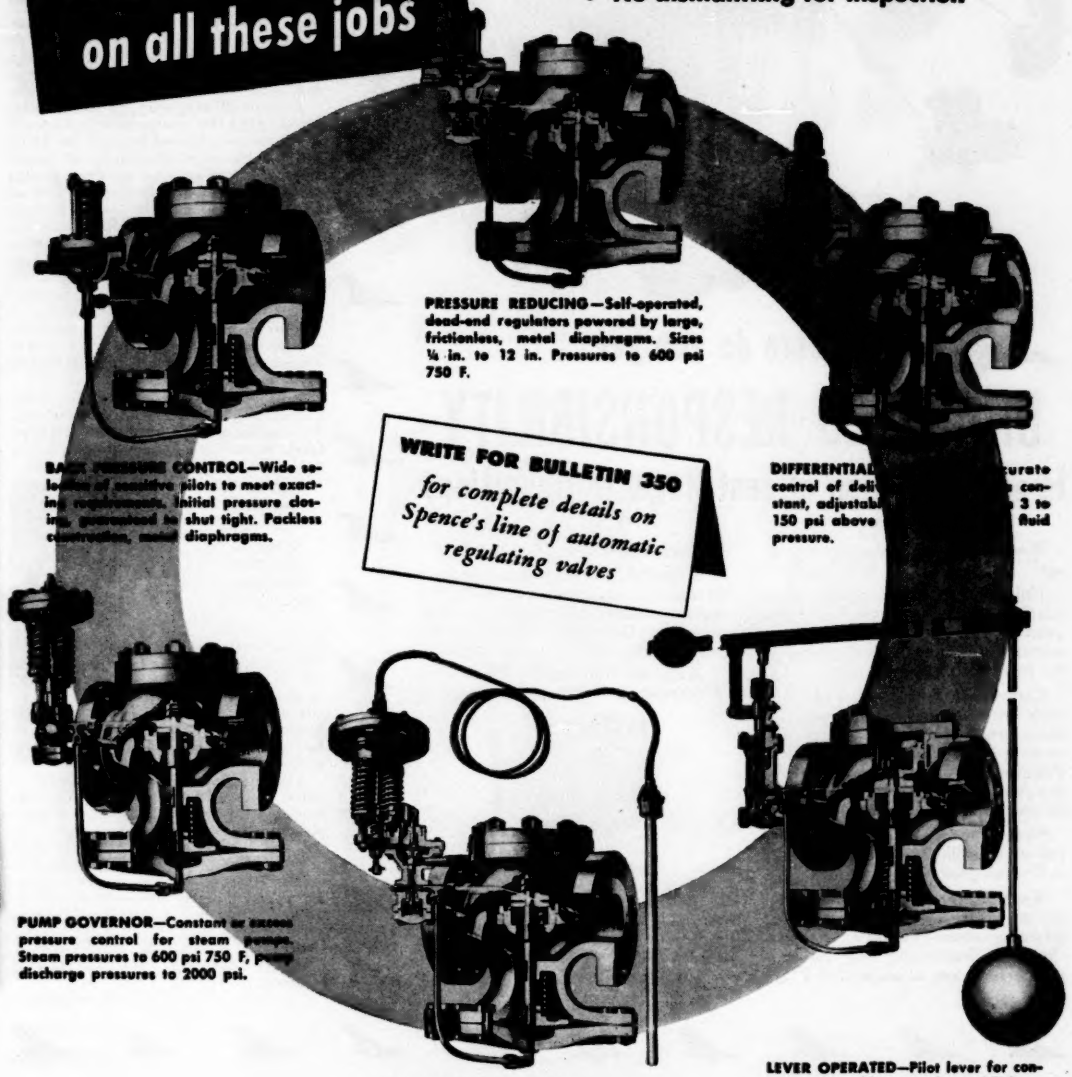
MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A-1.2

SAVE WITH SPENCE on all these jobs

Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:

- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing guaranteed to shut tight. Packless construction, metal diaphragms.

WRITE FOR BULLETIN 350
for complete details on Spence's line of automatic regulating valves

DIFFERENTIAL control of deli… stant, adjustab… 150 psi above … pressure.

…curate …con- …3 to …fluid

PUMP GOVERNOR—Constant or … pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.

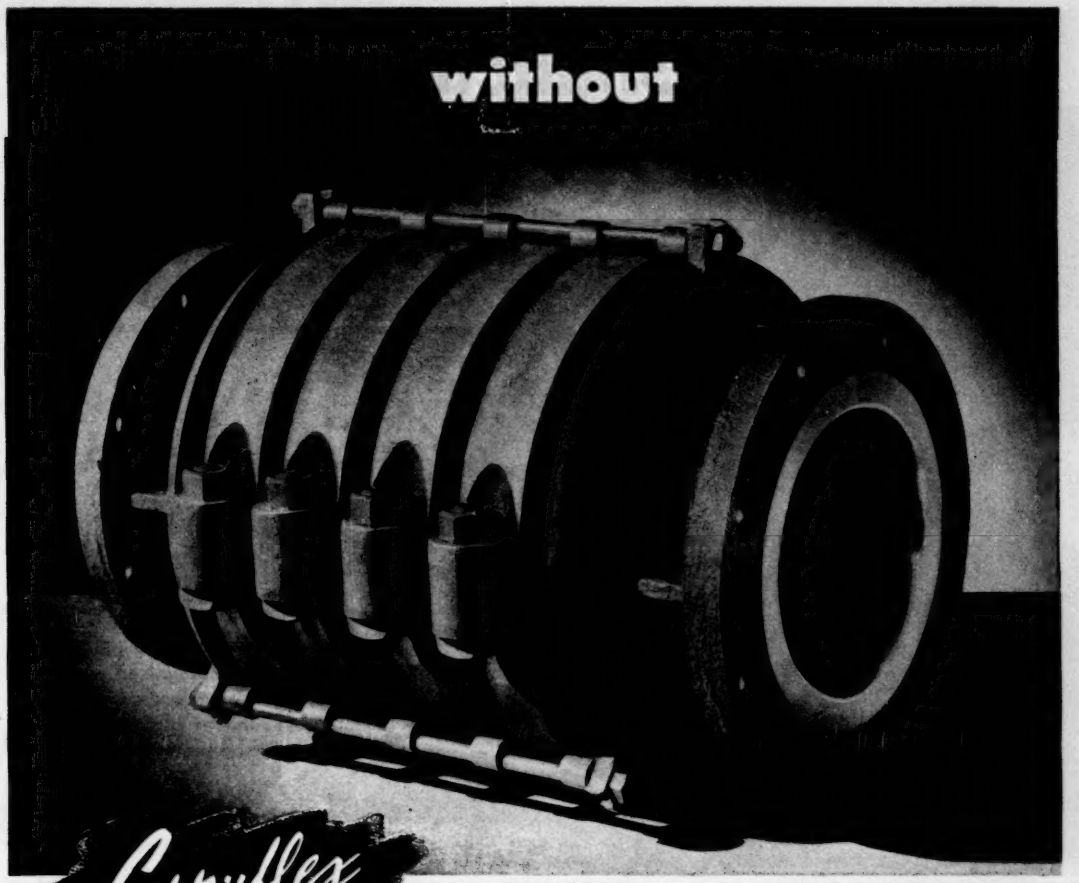
TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SE-119

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence



Corruflex PACKLESS EXPANSION JOINTS

No packing . . . no lubrication . . . no adjustment in service . . . no upkeep costs. You eliminate maintenance when you install *Corruflex* joints in your pipe lines. And, they're on the job all the time . . . absorbing expansion and contraction . . . protecting lines and equipment from strain. Full-time service without servicing!

Corruflex joints are more dependable, more efficient, longer lasting because they are made by the pioneers of the expansion joint industry.

They are available in sizes from 3" to 24", single or double units, single or multiple corrugations, with or without self-equalizing rings, and with flanged or welding ends. Supplied in copper, stainless steel or other alloys and with internal sleeves if required.

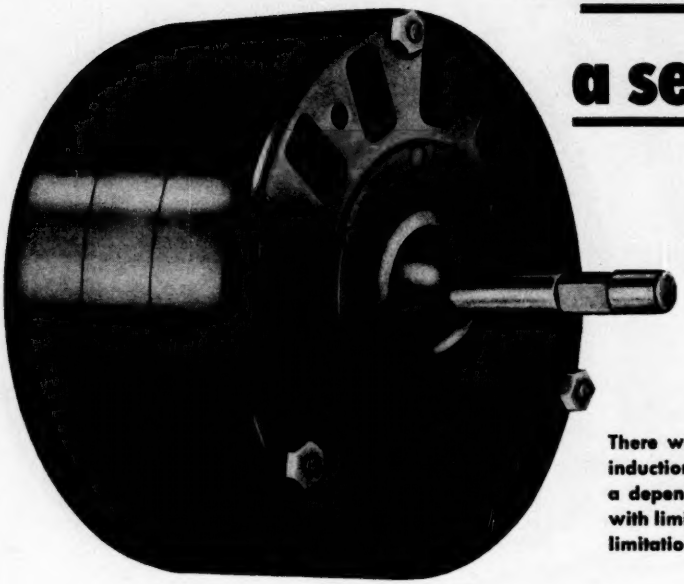
Corruflex joints have traverses ranging from fractions of an inch to 15" and operate under pressures from vacuum to 300 psi and temperatures from sub-zero to 1600 F.

Send for this 16-page Bulletin

Complete data on all *Corruflex* joints...simplified selection charts ...summary of installation practice...*Bulletin No. V-35-51.*

AMERICAN DISTRICT STEAM COMPANY, INC. • North Tonawanda, N.Y.

This is a shaded pole motor ...and it's worth a second look!



There was a time when shaded pole induction motors were recognized as a dependable, low-cost power source with limitations . . . and the application limitations were well known.

But today advanced designs of shaded pole motors have added new qualities, new versatility.

For example, the motor frame illustrated, FASCO's 3A3 (6-pole, 1000 RPM), can be furnished in ratings up to $^1/_{15}$ h.p. . . . with an overall length, less shaft, of only $3^5/_{16}$". That's compact, inexpensive power.

Other FASCO 6-pole motors, up to ⅛ h.p., are available in *reversible* models (the *only* reversible shaded pole motors).

Multispeed windings are available in many FASCO motors. And *built-in* protection against overheating can be furnished on *any* FASCO motor. Special attention is paid to meeting UL requirements. All this may mean that shaded pole motors hold new interest for you.

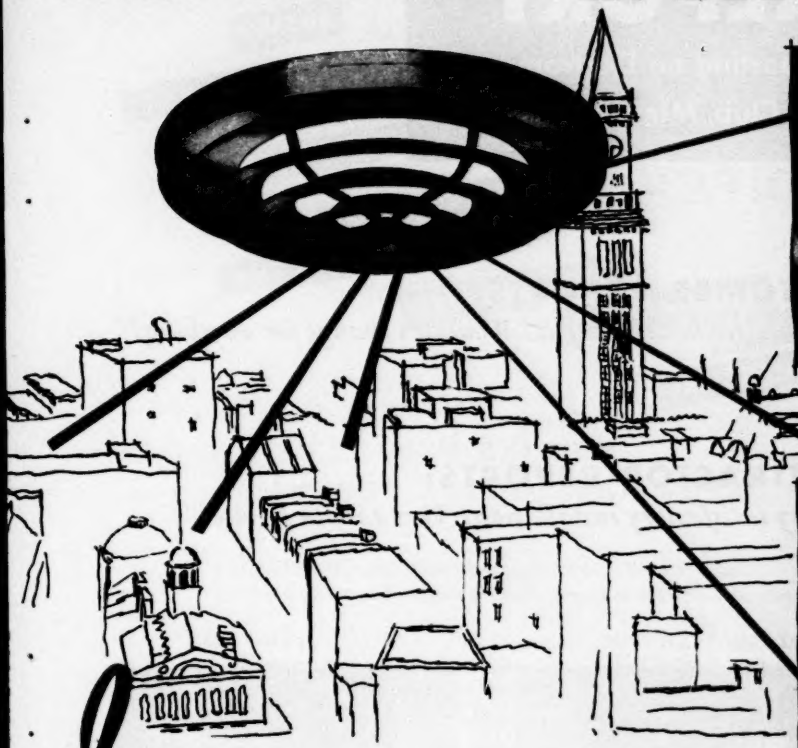
FASCO makes a wide range of small motors from $^1/_{500}$ to ⅛ h.p. Most are shaded pole induction motors in 2-pole, 4-pole, and 6-pole speeds.

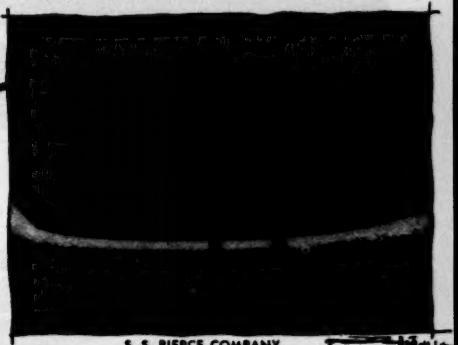
Let a FASCO engineer visit your plant and study *your* application. Matching the motor to the job requires painstaking development.

Cooperative, careful engineering is typical of FASCO customer service. Maybe it can do something for you. Write and see.

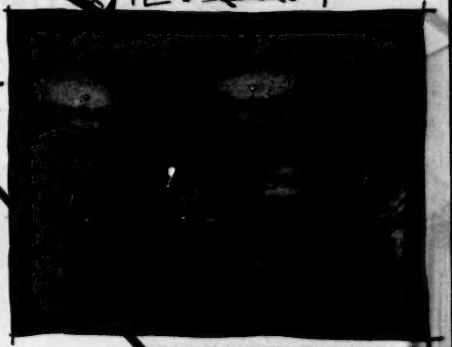
FASCO
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK

Aerofuse IN BOSTON





S. S. PIERCE COMPANY



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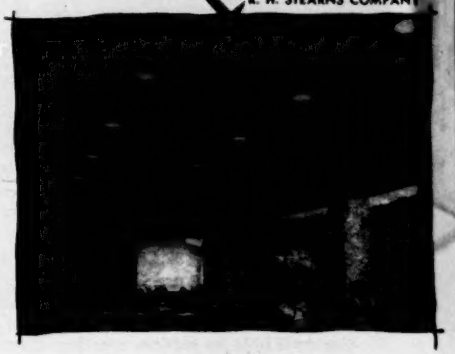
MASSACHUSETTS INSTITUTE OF TECHNOLOGY



R. H. STEARNS COMPANY

In the shadow of Bunker Hill . . . Old North Church . . . and the many other historic landmarks here . . . busy Boston enjoys the comfort and convenience of modern air conditioning in its up-to-date commercial, industrial and institutional buildings.

As is the case in other cities from coast to coast, important air conditioning jobs in Boston are Aerofuse Diffuser jobs. Selected on the basis of efficient, dependable performance . . . and smart styling that blends architecturally with modern interiors . . . Aerofuse Diffusers meet the most exacting requirements at the *vital point of air delivery*, the point at which the success of an air conditioning installation is measured.

There's a complete Aerofuse line . . . a type and style to meet every job specification. For complete details, size selection information and engineering data, write for Catalog 104.

Other Typical Aerofuse Installations in the Boston Area

Peter Bent Brigham Hospital
Public Service Building
Veterans Hospital, Roxbury, Mass.
Brookline Trust Co., Brookline, Mass.
Junior High School, Somerset, Mass.

TUTTLE & BAILEY inc
NEW BRITAIN, CONNECTICUT

ENGINEERED PRODUCTS FOR HEATING, AIR CONDITIONING AND VENTILATING

11TB51

FIELD REPORT

...actual quotations reporting on Electromaze installation at Commerce Club, Minneapolis, Minn.

MR. J. WILLIAMS
proprietor, Commerce Club

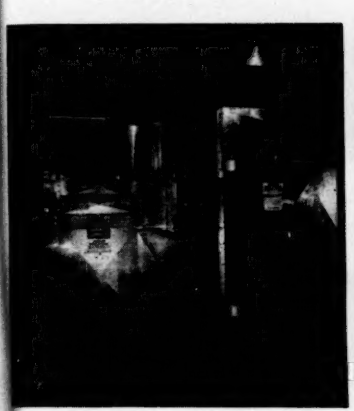
CUSTOMER REPORTS:

"The Electromaze is perfect! Wouldn't change for anything!"

MR. WILLIAM H. GAUSEWITZ
Yale Engineers, Inc.

CONTRACTOR REPORTS:

"A very satisfactory installation! Very easy to service!"



Assembly view, Electromaze unit, Commerce Club, Minneapolis.

Upstream view. Note how diffuser plates are integral with each "file drawer", eliminating need for separate installation.

Downstream view. Note open construction permitting quick and easy servicing.

EASIEST TO INSTALL! Electromaze is a new kind of electrostatic dirt precipitator made up of individual cells that slide in and out like filing cabinet drawers. Cellular frames come in pre-fabricated sections. All you do is bolt the sections together. Contractors report that Electromaze requires 50% *less* time and effort to install!

EASIEST TO CLEAN! Due to extra-wide collector plate spacing in Electromaze cells, the filter can be quickly cleaned in place with a pressure hose. If manual cleaning should become necessary, the cells can be readily removed for cleaning. Ask your consulting engineer or contact your nearby Air-Maze representative. Air-Maze Corporation, Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE

THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

PITTSBURGH
OMAHA
NEW ORLEANS
MINNEAPOLIS
WASHINGTON, D. C.
JACKSONVILLE
SALT LAKE CITY
ORANGEBURG, S. C.
PORTLAND, ORE.
CHICAGO
SAN FRANCISCO
ST. LOUIS
ALBANY

WHEREVER YOUR LOCATION...

YOU ARE ALWAYS CLOSE TO CLEAVER-BROOKS FACTORY-AUTHORIZED SERVICE

CLEAVER-BROOKS steam boiler service facilities are national — to enable you to get the most in performance through proper care and maintenance of your boiler.

YOU GET...

Starting Service: Boilers are placed in operation by Cleaver-Brooks field representatives who check installation, operation, and make a complete and detailed Field Report to you and to Cleaver-Brooks.

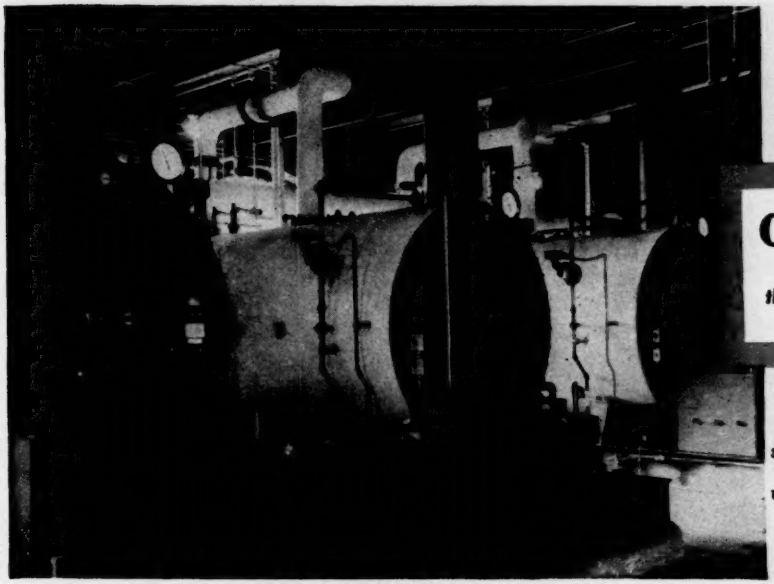
Operation Manuals: Your operators are trained in care and operation by Cleaver-Brooks and furnished with comprehensive, easy-to-understand operation manuals.

YOU HAVE READILY AVAILABLE

Parts: Cleaver-Brooks replacement parts are quickly available through field representatives, parts depots, and the factory.

YOU WILL FIND IT PAYS...

to equip with Cleaver-Brooks — steam boilers that operate at a guaranteed efficiency of 80% — burn gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp.; 15 to 200 PSI.



Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

CLEAVER-BROOKS COMPANY
316-J E. Keefe Ave., Milwaukee 12, Wis., U. S. A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Our plant stood in 10 feet of water

but here's where we stand today:

Here, you see our Ultralite insulation plant as you would have seen it from the air on July 15. Yet just 10 days later, we were shipping Ultralite glass fiber insulation out of undamaged inventory. And in another 14 days, Ultralite insulation was rolling off the assembly line again.

Production is rapidly approaching normal. Soon, very soon, a second Ultralite factory will go into full production — a huge, ultra-modern plant started long before the flood to help satisfy the demand for Ultralite. Soon, combined production in the two plants will make Ultralite more readily available than it has ever been before!

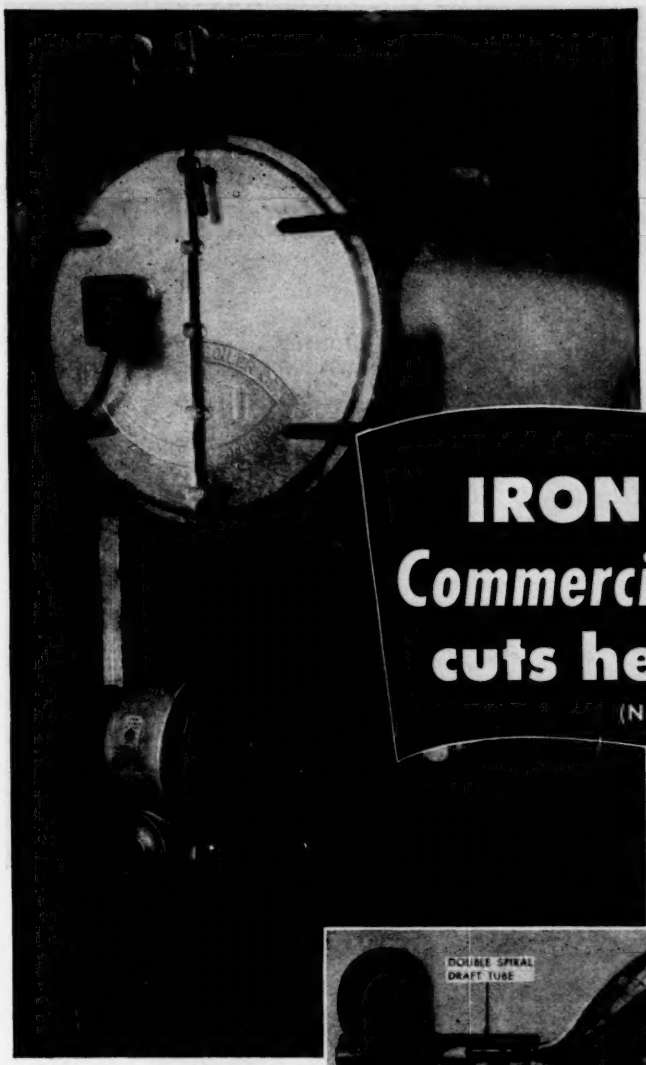
Already, protective measures for the future have been endorsed by the authorities, and plans have been completed. Higher, stronger dikes and levees will be built — dikes so much stronger than ever before that Gustin-Bacon is resuming production with full confidence that a similar disaster can never occur again.

GUSTIN-BACON MFG. COMPANY
CENTENNIAL BLDG. KANSAS CITY, MO.

New York Chicago Philadelphia San Francisco Los Angeles
Houston Tulsa Fort Worth

67 Ultralite Distributors throughout the country have stocks available to fill your insulation needs. Consult the yellow pages of your telephone directory.

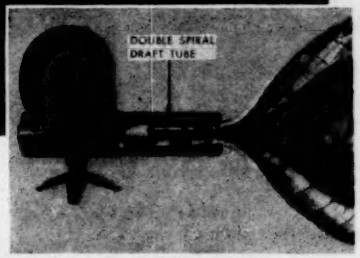
July 14: Flood water reaches the Ultralite insulation plant.



Can you afford to waste what Iron Fireman users are saving?

IRON FIREMAN *Commercial* OIL BURNER cuts heating costs

(No. 2 oil or lighter)



This steel heating boiler in one of the Portland (Oregon) plants of the Air Reduction Pacific Co., a division of Air Reduction Co., Inc. is equipped with an Iron Fireman Commercial oil burner. Iron Fireman pressure regulators (visible above boiler) are part of automatic control system. Capacities up to 65 boiler horsepower.

A careful inspection of the Iron Fireman commercial oil burner will show its advanced engineering design and the high quality of its materials and workmanship. Long years of dependable, economical operation are built into every burner.

Precision oil and air control are important engineering features, since these make possible the burner's top fuel economy. Iron Fireman oil burners have many extra values which appeal to careful, far-sighted owners of heating plants.

One example of advanced Iron Fireman engineering is the double spiral draft tube. This produces two air cones—one within the other—rotating in opposite directions. The result is maximum turbulence and excellent air and oil mixture for greater fuel economy.

You can get further information on this great Iron Fireman oil burner by calling your local dealer, or by mailing this coupon.

Other Iron Fireman equipment for coal, heavy oil, gas

Iron Fireman Coal-Flow Stoker
Feeds coal direct from bin. No coal handling. Coal and air automatically adjusted to boiler load at all times. Capacities to 400 boiler horsepower.

Iron Fireman Rotary Oil Burner
Fires low-cost, heat-rich heavy oils (5 & 6) with complete steadiness and dependability at varying oil temperatures. Capacities to 500 boiler h.p.

Iron Fireman Commercial Gas Burner
Vertical type is illustrated above. Others include Radiant Inshot and Ring types. Flexible operation, easy to install. Capacities to 400 boiler h.p.

IRON FIREMAN

AUTOMATIC FIRING EQUIPMENT FOR OIL, GAS, COAL

IRON FIREMAN MANUFACTURING COMPANY
3165 West 106th Street, Cleveland 11, Ohio.

Please send literature as checked:

☐ Commercial Oil Burner ☐ Rotary Oil Burner
☐ Coal-Flow Stoker ☐ Commercial Gas Burner

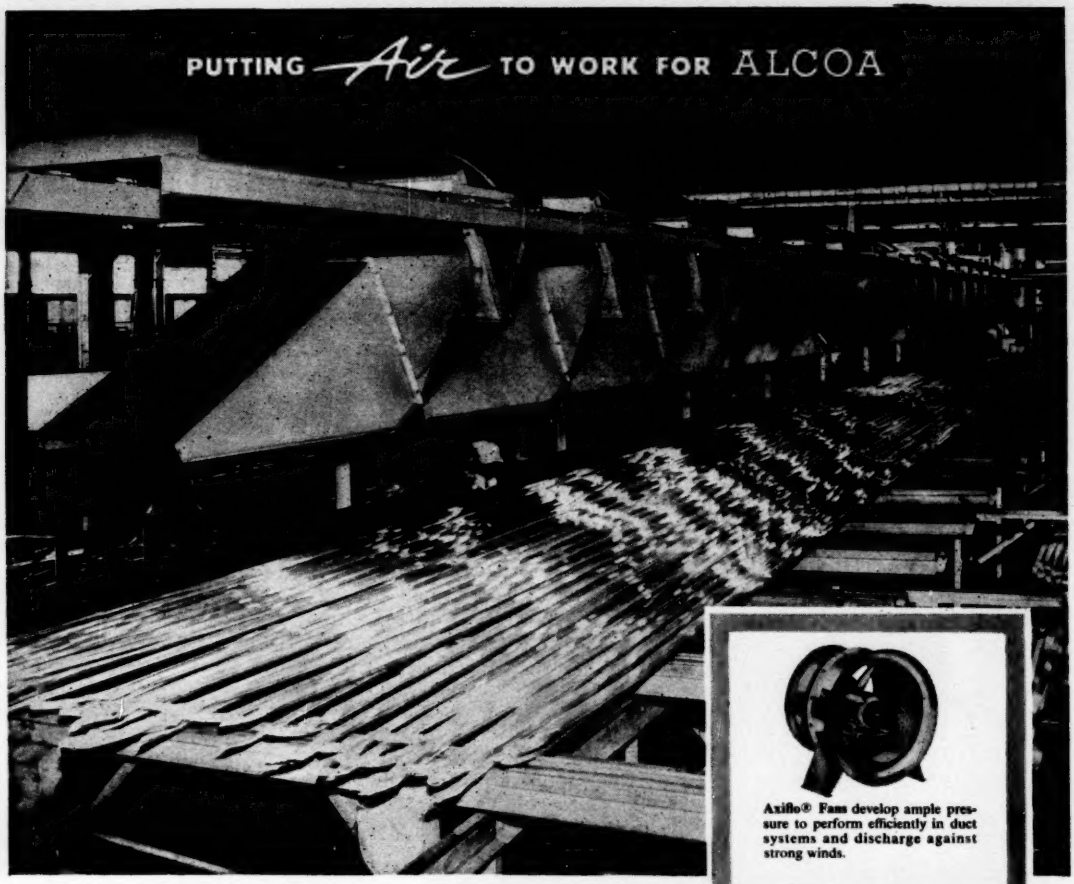
Let Iron Fireman engineers help decide which fuel is best for your plant.

Name _____

Address _____

City _____

State _____



Axiflo® Fans develop ample pressure to perform efficiently in duct systems and discharge against strong winds.

In Elbow Axiflo Fans, motors, belts and bearings are located outside the air stream, an advantage in handling corrosive fumes.

Silentvane® Centrifugal General Purpose Fans move air efficiently and quietly for many industrial and commercial applications.

BIG BREEZE

SOAKS UP 300° IN A HURRY

These 100-foot strips of structural aluminum are getting an air bath that sponges off 300° F. . . . but fast. A concentrated blast of air quenches the hot shapes leaving the forming mold . . . cools continuously for over 100 feet as they move down the line.

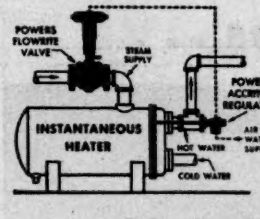
Mounted overhead are 17 Sturtevant Axial Flow Fans, delivering quenching air that helps maintain mechanical properties in the aluminum through quick, even cooling. These large capacity fans supply a steady stream of cooling air at high efficiency. Result: a uniform product for ALCOA.

There's Westinghouse equipment ready to help you *put air to work* too . . . whether it's with air handling, air conditioning, or electronic air cleaning. Call your local Westinghouse-Sturtevant office for full details, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

YOU CAN BE SURE...IF IT'S

Westinghouse

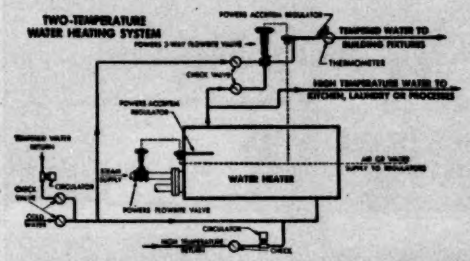
J-80226

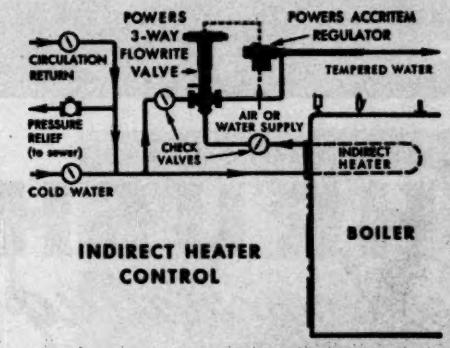


POWERS

ACCRITEM REGULATOR

Only a few of many uses





INDIRECT HEATER CONTROL

Easy to adjust

Compressed air or water operated

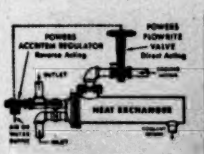
Gives

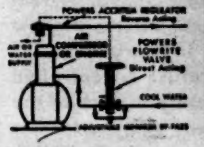
Accurate, Low-Cost Heat Control

Use Accritem Regulators to control diaphragm operated valves or dampers. They save labor, stop losses caused by over-heating and have the following—

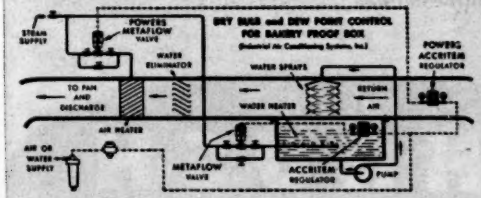
IMPORTANT ADVANTAGES

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures many years of reliable service.
- ***Temperature Ranges*** 50 to 250° F. and 150 to 350° F.
- ***Easy to Install*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long with ½" I.P.S. connection.





FLOWRITE and METAFLOW
Diaphragm Valves
controlled by a POWERS
ACCRITEM HEAT REGULATOR
provide an unbeatable combination for *better control* and *lower maintenance*



Write for Bulletin 316—or phone our nearest office for prices and further information about POWERS ACCRITEM regulators and diaphragm valves.

(AMH)

THE POWERS REGULATOR CO.

OFFICES IN OVER 50 CITIES • See Your Phone Book
CHICAGO 14, ILL., 2718 Greenview Ave. • NEW YORK 17, N. Y., 231 E. 46th St.
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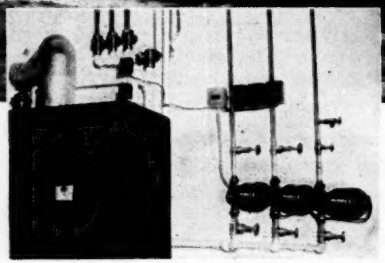
MEXICO, D. F., Apartado 63 Bis.

60 Years of Temperature and Humidity Control

Today's most modern homes . . .



. . . are heated with THRUSH *forced circulating* HOT WATER HEAT

A SIMPLE ZONED SYSTEM

Notice the compactness of this three-zone Flow Control System and the inexpensive units used. Just a Circulator, a Flow Control Valve and a No. 201 Radiant Heat Control in each zone. There are no costly motorized valves no complicated devices to give trouble. Temperature in each zone is maintained automatically.

HERE'S a beautiful new home heated economically with forced circulating hot water, with radiant coils in the ceiling providing completely automatic radiant heat in any weather. Thrush Flow Control System of Forced Circulating Hot Water Heat assures highest efficiency . . . uniform temperatures in every room . . . with no overheating. Room temperature is controlled within a fraction of a degree separately in each of the three zones. This is the heating plant your customers want. See your wholesaler today or write Dept. D-9 for more information.

Horizontal Water Circulator

Vertical Flow Control Valve

Ask for folder on Thrush Forced Circulating Flow Control System of Hot Water Heating.

H. A.
THRUSH
AND COMPANY
PERU, INDIANA

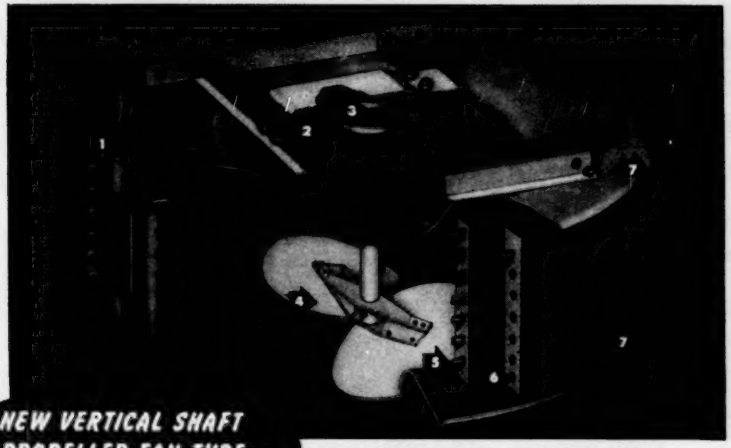
Heat for wherever it's Cold

THE MOS[illegible]MPLETE LINE OF UNIT HE[illegible] FOR INDUSTRIAL, INSTITU[illegible]AL AND COMMERCIAL BUILDINGS

Herman Nelson makes a unit heater for every heating purpose, and each is designed to provide peak performance at lowest operating cost. Constant research by Herman Nelson design engineers maintains a standard of quality that has been recognized throughout the years by both suppliers and users.

The functional design and construction of all Herman Nelson Unit Heaters insures easy installation and minimum maintenance. All units operate on either steam or hot water. All units are modernly styled and attractively finished.

Durable, rugged, long-lasting materials and superior craftsmanship in construction assure unit heaters that are second to none – units that will give years of efficient, trouble-free performance for any space heating requirement.

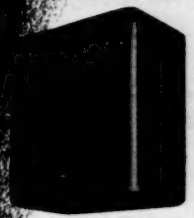


NEW VERTICAL SHAFT PROPELLER-FAN TYPE UNIT HEATER

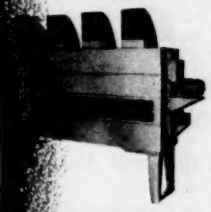
Comes in 3 models and 30 sizes. Five types of diffusers available.

1. Orificed radiator tubes assure proper steam distribution and eliminate air binding – no cold spots.
2. Motor has been especially selected for unit heater application.
3. Motor manufacturer's method of holding the motor cushion hub rings avoids undue pressure and distortion of the rubber. It also provides insulation of motor vibration between motor and cabinet.
4. Fan with wide face area of aerodynamic or streamline shape provides quieter operation.
5. Red brass tubing in radiator provides maximum heat transfer and resists corrosion.
6. Fins have holes for tubes, formed with flanged edges to provide permanent contact between tubes and fins and proper spacing between fins.
7. Attractive cabinet of heavy sheet steel finished in platinum green enamel.

Vertical shaft propeller-fan type unit heater – *especially suited to buildings with high ceilings – up to 50 feet.*



Horizontal shaft propeller-fan type unit heater – *the most generally useful of all space heaters.*



Centrifugal-fan type unit heater – *for efficient heating of large industrial space.*

De Luxe unit heater – *the most versatile product of its type, suitable for stores, offices, churches, etc.*

AAF herman nelson

HERMAN NELSON

Division of **AMERICAN AIR FILTER COMPANY, INC.**

MOLINE, ILLINOIS

Write for free unit heater data book.

THE CHICAGO PUMP IS A BETTER PUMP

Figure V 9500—Type AVC Condensation Pump and Receiver. Receiver serves as base. Low inlet — suitable for floor mounting or shallow pit. No foundation bolts necessary. Ask for Bulletin 245.

Figure L 9700—Type CLL1 Vertical Condensation Pump. Extra heavy duty unit. Specifically designed for low return service and underground installations. Ask for Bulletin 255.

. . . For Every Heating Purpose

Get the pump that is specifically designed for the particular job. For below floor returns, for low vacuum systems, for small capacity high pressure requirements, for any standard heating system or any unusual condition there is a Chicago Heating Pump that will do the job better.

All ratings and receiver capacities meet or exceed ASHVE standards.

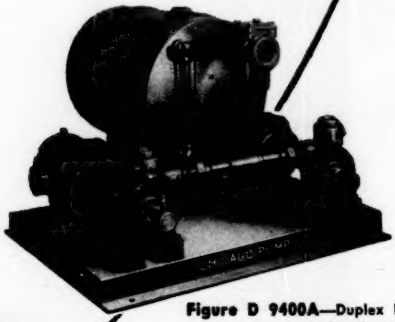
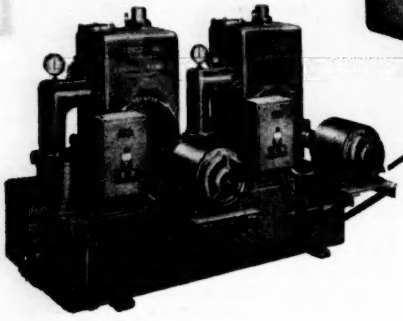


Figure D 9400A—Duplex FC Condensation Unit. For duty up to 50,000 EDR and discharge pressures up to 150 lbs. Ask for Bulletin 260.

Figure D 9900—Duplex Condo-Vac Return Line Vacuum and Boiler Feed Pump for vacuum heating systems. Pressures up to 40 lbs., and from 2500 to 150,000 EDR. Ask for Bulletin 270.



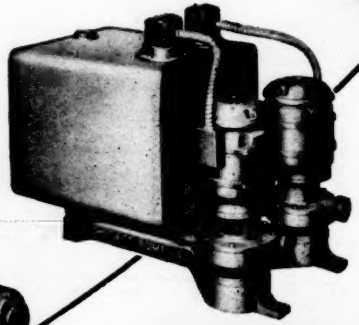


Figure D 9200—Sure Return Condensation Pump and Receiver. For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. Ask for Bulletin 250.

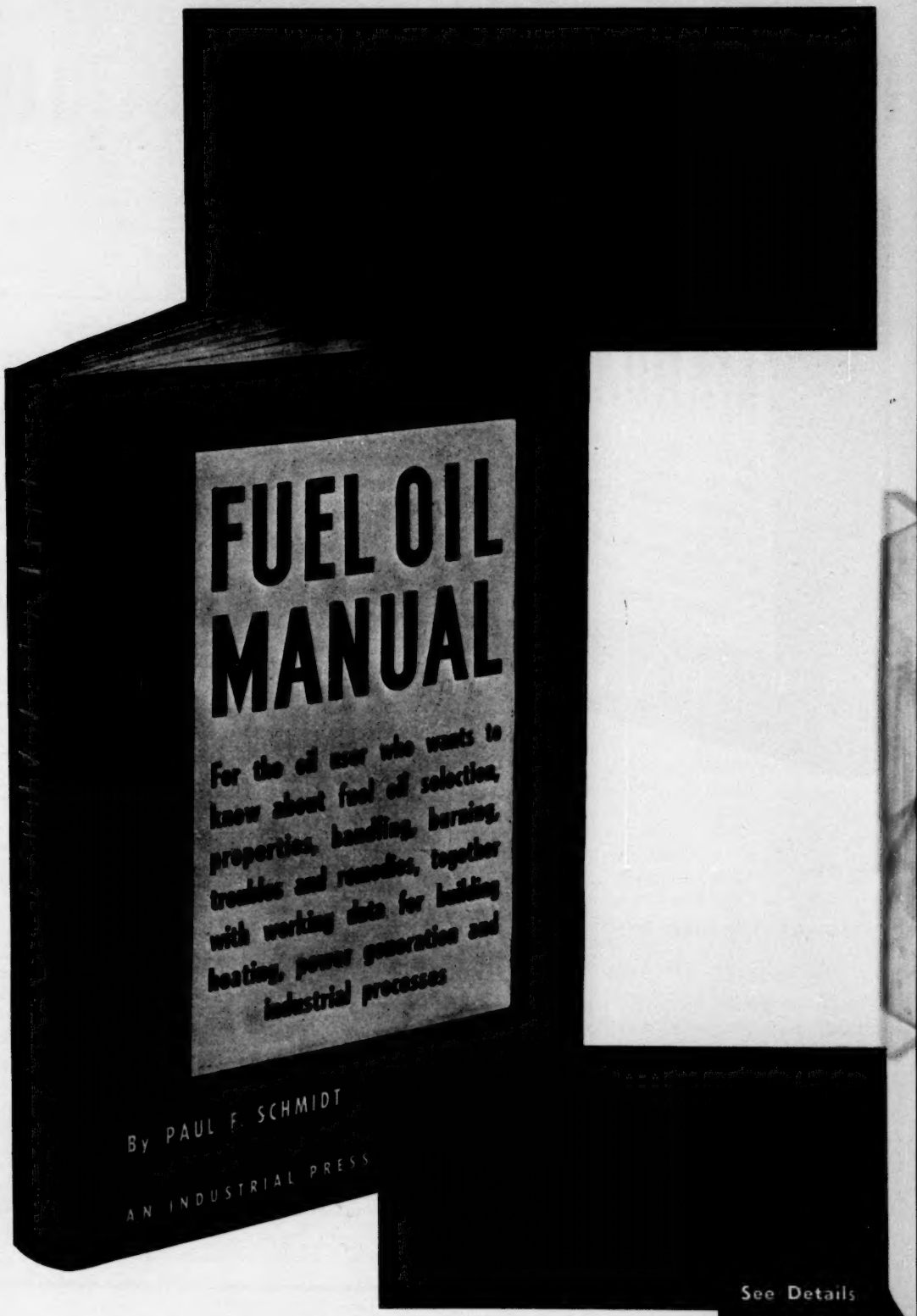
CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

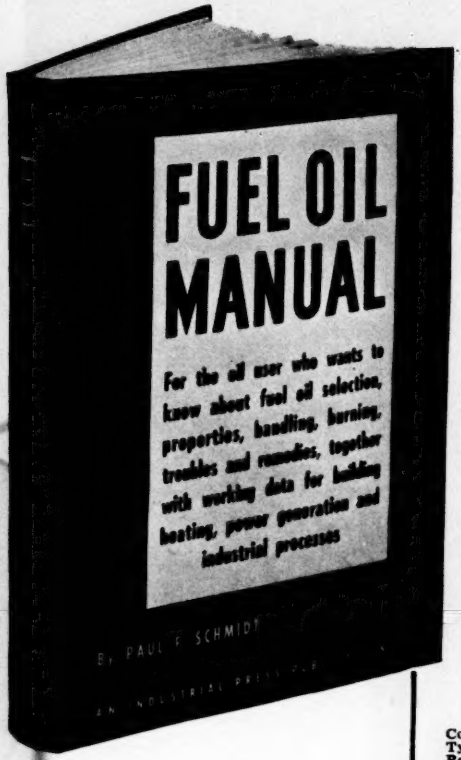
Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.


FUEL OIL MANUAL
For the oil user who wants to know about fuel oil selection, properties, handling, burning, troubles and remedies, together with working data for building heating, power generation and industrial processes
By PAUL F. SCHMIDT
AN INDUSTRIAL PRESS

See Details on Next Three Pages

PRACTICAL INFORMATION


FUEL OIL
MANUAL
For the oil user who wants to know about fuel oil selection, properties, handling, burning, troubles and remedies, together with working data for boiler heating, power generation and industrial processes
By PAUL F. SCHMIDT

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RECLAIMED FUEL OILS—Sources—Difference between Lubricating and Fuel Oils—Methods of Reclaiming—Troubles with Reclaimed Lubricating Oils—Appearance—Specifications—Other Types of Reclaimed Oils

BLENDING OF OILS—Grades of Oils Blended—Reasons for Blending—Methods of Blending—Blending by Heating, Agitation, Circulation and Gravitation

TRANSPORTATION AND STORAGE —Tank Car and Truck Delivery—Tanker and Pipeline Shipments—Method of Temperature Correction—Gauging of Storage Tanks—Abridged Volume Correction Table for Petroleum Oils — Capacities of Tanks — Oil Cost Table

FUEL OIL SPECIFICATIONS—No. 2 Distillates—No. 4 Oils—No. 5 and 6 Oils

COMPLAINTS AND CAUSES OF TROUBLE—Complaints or Symptoms, their Causes and Remedies—Unable to Start—Flame Goes Out or Fluctuates—Spitting, Sputtering, Sparkling—Poor Atomization and Combustion—Loss of Heat — Flash-back — Carbonization of Burner Tip — Carbon Formation on Furnace Walls—Carbon in Preheater—Blocked Burner Tip—Excessive Soot—Excessive Oil Consumption — Blocked Screens — Plugged Lines — Oil Not Pumpable—Loss of Suction—Water—Smoke — Corrosion — Discoloration of Ceramics — Bad Odor

ON *Properties Selection Handling Burning* OF FUEL OIL

If you *buy* fuel oil—**Do you know how to compare the properties of various grades and types? . . . how to specify and select the right oil for your purpose?**

If you *use* fuel oil—**Do you know the factors which influence efficient combustion? . . . how to analyze fuel oil troubles and apply the proper remedies?**

If you *sell* fuel oil—**Are you able to advise your customers intelligently? Can you answer their questions about fuel oil properties? . . . help them when trouble occurs?**

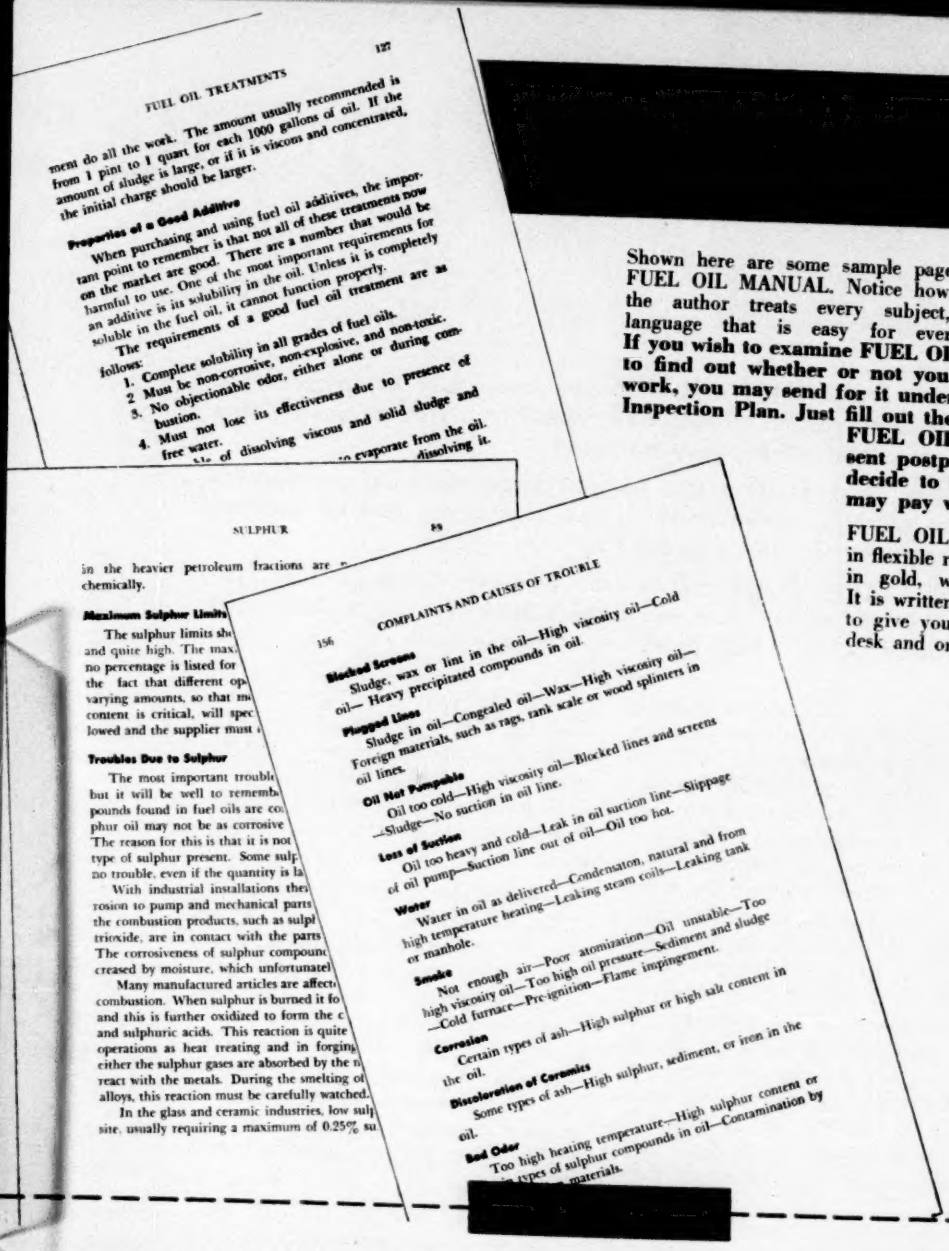
If you buy, use or sell fuel oil for building heating, power generation, marine applications or industrial processes, you will find FUEL OIL MANUAL, by Paul F. Schmidt, a convenient source of practical information that will give you a working knowledge of fuel oil and how to use it. Written by a chemist with many years' experience in the industry, it discusses fuel oil from the standpoint of the user. Theory and involved discussions of interest only to chemists or refiners are avoided. Step by step, starting with a brief description of the chemistry of petroleum and methods of refining, FUEL OIL MANUAL gives a comprehensive picture of the characteristics and uses of every type and grade of fuel oil, from No. 2 to No. 6. Technical language is avoided wherever possible, and all the terms used are fully explained.

The complete table of contents at the left illustrates how thoroughly the subject is covered. A chapter is devoted to each of the various important properties of fuel oil. In each case the author explains fully the meaning of each property, and shows how this information can be applied in selecting, handling or burning fuel oil. Fuel oil impurities and how they affect combustion are described fully, and the steps which can be taken to test for or avoid impurities are discussed. Of special interest is the chapter on Fuel Oil Treatments, which clears up a lot of misunderstanding on this subject, describes what a fuel oil additive can or cannot do, and analyzes the essestial qualities which should be considered in selecting a fuel oil additive.

Another chapter which every user of FUEL OIL MANUAL will find valuable is the one on Troubles and Remedies. Here the author lists the troubles that may be encountered in using fuel oils, describes the symptoms of each, and shows the correct remedy to apply in each case. Many cases of fuel oil failure can be prevented or quickly remedied by becoming familiar with the contents of this chapter.

FUEL OIL MANUAL will give you a thorough knowledge of the properties of fuel oil . . . of the possibilities and limitations of each grade . . . of the methods you can use to assure uniform quality and efficient combustion . . . of how to diagnose fuel oil troubles and remedy them. It is a valuable addition to your working library that will show you how to get maximum value for your fuel oil dollar in every kind of application.

160 Pages 34 Tables **$3.50** **Sent Postpaid in U. S.**



FUEL OIL TREATMENTS 127

ment do all the work. The amount usually recommended is from 1 pint to 1 quart for each 1000 gallons of oil. If the amount of sludge is large, or if it is viscous and concentrated, the initial charge should be larger.

Properties of a Good Additive

When purchasing and using fuel oil additives, the important point to remember is that not all of these treatments now on the market are good. There are a number that would be harmful to use. One of the most important requirements for an additive is its solubility in the oil. Unless it is completely soluble in the fuel oil, it cannot function properly.

The requirements of a good fuel oil treatment are as follows:

1. Complete solubility in all grades of fuel oils.
2. Must be non-corrosive, non-explosive, and non-toxic.
3. No objectionable odor, either alone or during combustion.
4. Must not lose its effectiveness due to presence of free water.
5. ... of dissolving viscous and solid sludge and ... evaporate from the oil. ... dissolving it.

SULPHUR 89

... in the heavier petroleum fractions are ... chemically.

Maximum Sulphur Limits

The sulphur limits sh... and quite high. The max... no percentage is listed for ... the fact that different op... varying amounts, so that m... content is critical, will spec... lowed and the supplier must ...

Troubles Due to Sulphur

The most important trouble ... but it will be well to remember ... pounds found in fuel oils are co... phur oil may not be as corrosive ... The reason for this is that it is not ... type of sulphur present. Some sulp... no trouble, even if the quantity is la...

With industrial installations ther... rosion to pump and mechanical parts ... the combustion products, such as sulph... trioxide, are in contact with the parts ... The corrosiveness of sulphur compound... creased by moisture, which unfortunatel...

Many manufactured articles are affect... combustion. When sulphur is burned it fo... and this is further oxidized to form the c... and sulphuric acids. This reaction is quite ... operations as heat treating and in forging ... either the sulphur gases are absorbed by the ... react with the metals. During the smelting of ... alloys, this reaction must be carefully watched.

In the glass and ceramic industries, low sulp... site, usually requiring a maximum of 0.25% su...

156 COMPLAINTS AND CAUSES OF TROUBLE

Blocked Screens
Sludge, wax or lint in the oil—High viscosity oil—Cold oil— Heavy precipitated compounds in oil.

Plugged Lines
Sludge in oil—Congealed oil—Wax—High viscosity oil—Foreign materials, such as rags, tank scale or wood splinters in oil lines.

Oil Not Pumpable
Oil too cold—High viscosity oil—Blocked lines and screens —Sludge—No suction in oil line.

Loss of Suction
Oil too heavy and cold—Leak in oil suction line—Slippage of oil pump—Suction line out of oil—Oil too hot.

Water
Water in oil as delivered—Condensation, natural and from high temperature heating—Leaking steam coils—Leaking tank or manhole.

Smoke
Not enough air—Poor atomization—Oil unstable—Too high viscosity oil—Too high oil pressure—Sediment and sludge —Cold furnace—Pre-ignition—Flame impingement.

Corrosion
Certain types of ash—High sulphur or high salt content in the oil.

Discoloration of Ceramics
Some types of ash—High sulphur, sediment, or iron in the oil.

Bad Odor
Too high heating temperature—High sulphur content or ... types of sulphur compounds in oil—Contamination by ... materials.

Shown here are some sample pages taken directly from FUEL OIL MANUAL. Notice how clearly and concisely the author treats every subject, using non-technical language that is easy for everyone to understand. **If you wish to examine FUEL OIL MANUAL further, to find out whether or not you can use it in your work, you may send for it under our Five Day Free Inspection Plan. Just fill out the coupon below and FUEL OIL MANUAL will be sent postpaid at once. If you decide to keep the book you may pay within five days.**

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HV-9/51

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Simple Arithmetic for Oil Burner Installations!

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1. Equipment Costs Reduced: Thermal Electric gets rid of steam coils in the storage tank, recirculation, remote pump-sets, multiple suction lines, and all the gadgets that go with them. In bidding, you won't have to pad for unforeseen extra equipment . . . and run the risk of losing the contract. Thermal Electric's simplicity and the ease with which you can figure your exact equipment needs mean safe, accurately figured, competitive bids for Thermal Electric installations.

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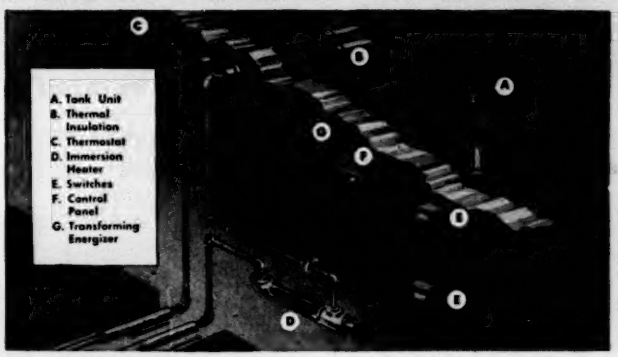
3. Lower Costs, Lower Bids, More Contracts: These savings enable you to make lower bids or to take greater profits at your usual markup. Or, playing it smart, you can get new business by submitting Thermal Electric as a more efficient, lower priced alternative to any other method you're asked to bid on.

4. Freedom From Service — Guaranteed: Not only does Thermal Electric's performance record prove it, but Fluid Systems *guarantees* it! Read the unqualified guarantee in the right hand column which assures contractors complete protection against service headaches.

Now look at all these other advantages: *No coking* — Thermal Electric maintains steady, accurate heat without hotspots. *No stratification* — Thermal Electric removes fuel from *unheated* storage. The bulk of the fuel stays solid until melted for immediate use. *No more freeze-ups* — Thermal Electric automatically keeps fuel at flow temperature without constant or cycle burner operation. In one case, a Thermal Electric System was unknowingly left on for three years while the burner was shut down. The bunker fuel flowed *immediately* upon starting the burner! (Documented proof available on request.)

5. Good Installations Mean More Business: The contractor who builds his reputation for good, trouble-free bunker oil installations with Thermal Electric will find quality business coming to him — and he won't have to cut his markups to get it. Build for more profits now by getting the Thermal Electric story and the simple cost estimating forms with which you can prepare your bid *in five minutes* for profitable Thermal Electric installations.



THIS IS THERMAL ELECTRIC: Thermal Electric is a completely automatic, all-electric system of transporting #6 bunker oil from unheated storage to the oil burner(s) at 120°F. The Transforming Energizer passes safe, low-voltage current through the pipes carrying the oil. The oil is heated evenly over the entire system —no hotspots or coking. The system can be shut down without draining. Flip the switch — the solidified fuel melts and flows, with no blow-torches!

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You can't overlook a thing. The simple calculations cover every item for a complete Thermal Electric installation. You do not have to consult us before bidding.

Get these forms and keep them on hand. With them you'll be able to submit fast, accurate, safe bids and land profitable Thermal Electric contracts.

WORKS WITH ANY BURNER

Outstanding Thermal Electric Installations have been made in combination with these burners:

Ray • York • Petro • Johnson • Todd Enterprise • Iron Fireman • Preferred Gilbarco • Superior • Ames • Cyclotherm Rexoil • Hauck • Cleaver-Brooks North American • Ace • Indiana and many others

Guarantee

When installed according to installation specifications, Fluid Systems, Inc. *guarantees* that Thermal Electric will (1) remove #6 fuel from underground storage without auxiliary heat in storage and (2) deliver fuel at 120°F. to each burner connection under all conditions of flow or standby.

What other system gives you this protection?

Send Coupon Now!

PAT. NO. 2,524,403

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*Address*_____

*City*_____ *State*_____

☐ P.S. Send the proof about that three-year shutdown!

HVC-2

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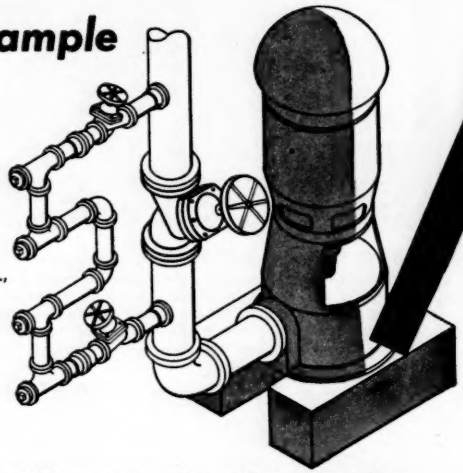
...for example



The Installation—
Barr Rubber Products Co., Sandusky, Ohio

PROBLEM: To eliminate costly seating and packing maintenance, and frequent replacement of valves on plant well-water pump. Valves previously used highly unsatisfactory, having maximum life of 6 months.

WORKING CONDITIONS: Sulphur content of water extremely high. Valve constantly exposed to severe corrosive and erosive effects. Operated infrequently; yet easy operation, positive seating are prime requisites.

SOLUTION TO PROBLEM: Crane Packless Iron Body Diaphragm Valves featuring separate disc and diaphragm design. Three-inch No. 1611 flanged end valve on main discharge; ¾-inch No. 1610 screwed end valves on by-pass.

RESULT: While other valves lasted only 6 months or less, Crane Diaphragm Valves show no effects of service, after more than a year. They operate smoothly . . . seat tightly . . . no maintenance whatsoever needed to date!

Another typical demonstration of superior quality, and the low-cost performance of Crane Valves. That's why . . . More CRANE VALVES are used than any other make!

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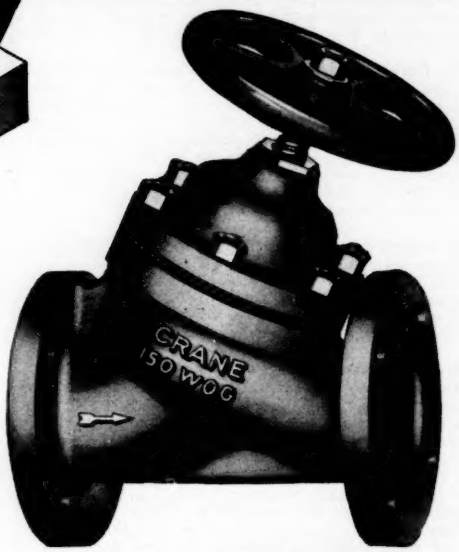

No. 1611 Crane Iron Body Diaphragm Valve —one of a full line suited for many services. Literature on request from your Crane Branch or Crane Wholesaler.

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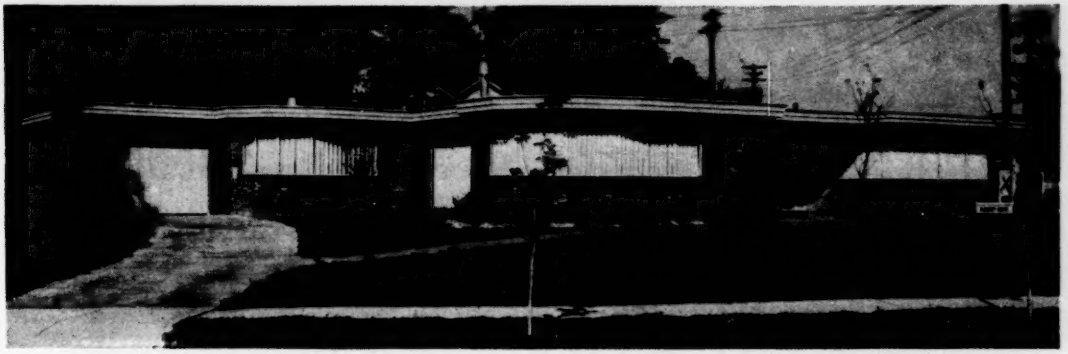
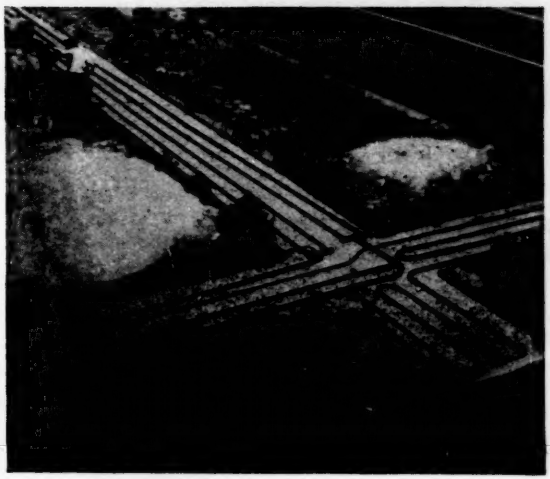


A mile of pipe for a mile-high house!



● "Sun-Age Homes"* are well-known in mile-high Denver. Windows are big (over 40% of wall area). Plenty of storage space is built-in. The functional design makes for easy living. And—

Radiant heating is an important selling feature of every Sun-Age Home. The interior, plus the driveway and sidewalk snow-melting system are heated with 6000 feet of NATIONAL *Steel* Pipe—the standard pipe for hot-water heating for over 60 years.

In the first 10 days that this sample home was displayed, over 8,000 adults visited it. *90%* of these people requested more information on radiant heating and snow melting. This intense public interest in the comfort and convenience of these systems has helped to sell a lot of Sun-Age Homes—just as it's helping to sell homes in every part of the country.

NATIONAL *Steel* Pipe is just the thing for an installation like this. It's economical. It's easy to weld. It's strong. Yet it's ductile enough to allow easy bending.

If you are planning a future radiant heating installation for a home, garage, store, church, terminal, factory, warehouse or plant, remember that NATIONAL—the world's largest selling pipe—has all the qualities that make for successful application.

**Trade Mark, Reg.*

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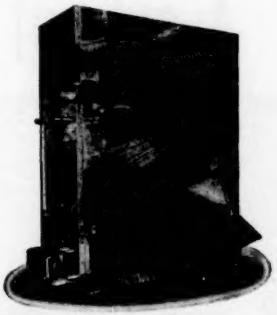
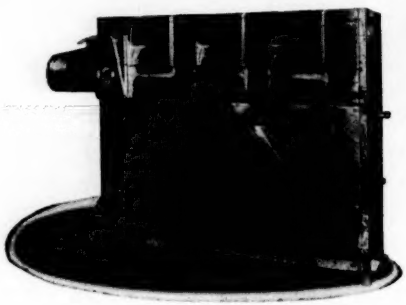
1. Heavier, extra strong construction for durability. **2.** Complete moisture elimination for dry fan operation. **3.** Save more than 90% of the water required. **4.** Built in 3 sections for easy shipment and installation. **5.** Flexible fan arrangement. **6.** Hot-dip galvanized *after* fabrication. **7.** Internally mounted receivers for added storage capacity. **8.** Provision for Micromet threshold water treatment. ALL the above features, with the exception of "internally mounted receivers" and "Micromet threshold water treatment" are also available in ACME Heavy Duty Cooling Towers.





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1. Units available for Dry Coil or Brine Spray Operation. **2.** Available for flooded, direct expansion or brine operation. **3.** Coils may be either prime surface or finned; tubes of copper or steel pipes. Fins aluminum or steel. Coils, steel pipes and fins may be hot-dip galvanized. **4.** Vertical or horizontal discharge, easy accessibility to coils. **5.** Economical to operate. **6.** Air inlet front or back.

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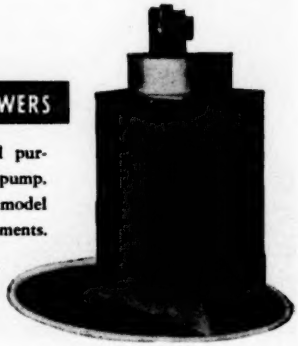
1. Versatile — Model for all purposes. **2.** With or without pump. **3.** An ideal Jobber item, stock model can be used to meet all requirements.



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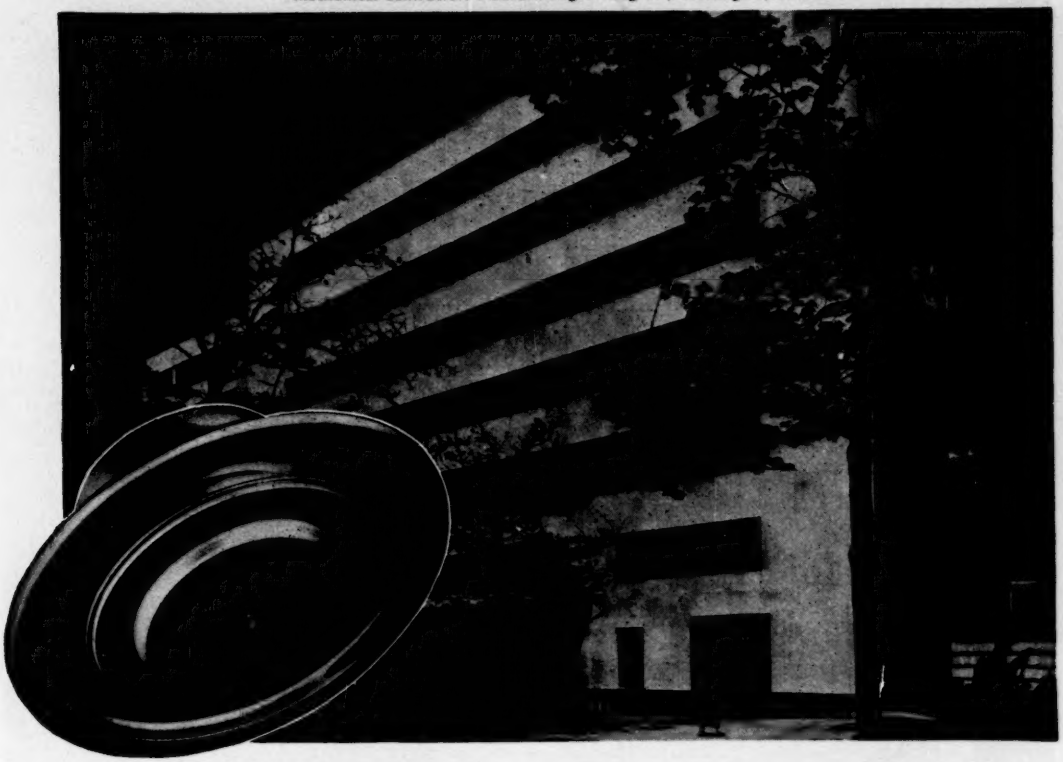

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Of all the materials used for ordinary sheet-metal work, steel is the strongest and stiffest.

This means that galvanized steel has less tendency to buckle or kink when it is handled. It usually requires less bracing or stiffening, and can be used in longer sections than sheets made from other metals. Steel sheets also have more resistance to damage from denting or punching.

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When you consider the excellent quality, the low cost and the easy workability of Bethlehem Galvanized Sheets, you can see why they are in constant demand by sheet-metal contractors and fabricators.

Bethlehem
GALVANIZED
Steel Sheets

BETHLEHEM STEEL

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Washington News

LORING F. OVERMAN

RECOMMENDATIONS for "planned industrial expansion over the next five or six years, aimed at long-range solution of basic materials shortages," are soon to be announced by Defense Production officials. DPA's intent to announce such a plan was revealed in mid-August before a House Small Business Subcommittee hearing. For some reason, Washington newsmen did not give the news the usual eight-column banner headline, and no one even hinted editorially that here was proof that defense controls would be the stepping stones to socialized planning.

Such ideas have been voiced by many political observers, and it is rather surprising to see this particular reference slip by without editorial challenge. Perhaps with materials, wages, salaries, prices and rents controlled more or less, a hint of continued planning has been made merely as a trial balloon.

In any event, members of the House subcommittee heard the news from Melvin Anshen, Assistant Deputy Administrator for Program and Requirements of DPA. For the most part, Mr. Anshen explained the operations of the Controlled Materials Plan, and of the government agencies making the various program determinations.

He then disclosed that his planning staff will shortly advance recommendations for planned industrial expansion over the next five or six years. He indicated that the various programs for long-range expansion will encounter initial obstacles because preliminary estimates of the required materials will total up to more steel, copper and aluminum than can be devoted to such programs for some time.

Mr. Anshen also explained that dispersal of industry raises extremely difficult problems. Dispersal, he said, creates added requirements for scarce materials and resources over those needed for construction of any new industrial facility. He explained, as an example, that construction of a new aluminum plant originates heavy requirements for power and creates a need for materials for housing and community facilities.

Whether or not Mr. Anshen's remarks are to be taken merely as an unauthorized slip of the tongue or as a trial balloon remains to be seen. The Wilsons of NPA and the Johnstons of ESA have been speaking in terms of "controls for a year or two," and Mr. Anshen's revelation that planning for five or six years ahead is in the mill comes as a confirmation of some thinking.

Probabilities are that, whether officially approved or not, Mr. Anshen's observations tread fairly close to the truth. At any rate, what was to have been a "little" defense program has already grown into a genie whose demands are never satisfied.

Appetite Affects HV and A-C.

In recent weeks the ravenous appetite of the defense program has taken several bites out of the heating, ventilating and air conditioning industry's feed trough.

The Construction Order was further tightened.

The Open-End CMP plan was closed.

Extension of natural gas service was limited.

Petroleum capacity was scrutinized.

In bringing all construction under the Controlled Materials Plan on October 1, NPA will consider four classes of essentiality in determining whether to approve the project and allocate the necessary materials. The four classes are as follows:

Class 1: This group will include construction projects which will further the defense effort by providing facilities in areas adjacent to military establishments or defense plants which NPA considers necessary to furnish or supplement facilities in connection with activities of the Defense Production Administration, Department of Defense, or the Atomic Energy Commission. These include such projects as steel, aluminum and aircraft expansion facilities construction.

Class 2: Construction classified as essential to the maintenance of public health, safety or welfare is included in this group. All industrial construction and plant expansion, following issuance of certificates of necessity, which had been started before August 3, 1951, will get Class 2 priority.

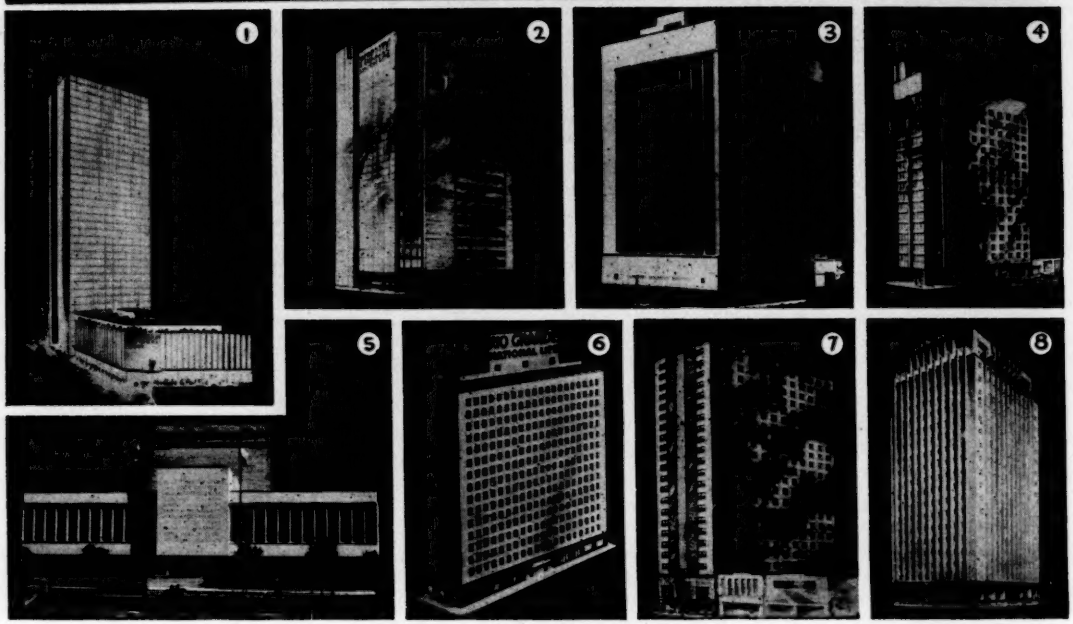
Class 3: Falling in this group is construction required as a result of fire, flood or disaster materially affecting the public interest; or where it is essential to meet the needs of the community. (NPA will consider community need only when certified by responsible government officials.) Industrial construction and plant expansion pursuant to certificates of necessity issued after August 3, 1951, or where the certificate was issued before August 3 but construction did not begin until after August 3, will be given Class 3.

Class 4: All other industrial construction will be given a Class 4 priority.

NPA said that since quantities of controlled materials for plant expansion and industrial construction are not adequate to meet the requirements of all industrial construction demands, the test of relative need and essentiality must be applied. In these cases, the recommendations of the claimant or sponsoring agency or NPA industry division must be obtained and screened to determine what construction can be deferred. NPA said that in making this determination it will consider the effect upon the defense program and the civilian economy if the controlled materials required are not made available for construction for each plant expansion.

In discussing Class 4 construction, NPA indicated that allotments will not be made for recreational types of construction listed in revised NPA Order M-4A, (Table 1), unless the applicant submits proof of unreasonable hardship if the request is denied. Types of Class 4 projects which will receive NPA consideration include:

These newcomers push the DALLAS SKYLINE UP . . .



BYERS WROUGHT IRON PIPE holds maintenance DOWN!

Here's a lineup of eight newcomers to the Dallas Skyline that upholds the Texas reputation of doing things in a big way. The fact that the job is being done in the *best way* is suggested by the selective use of Byers Wrought Iron pipe in a variety of services. Here's the breakdown:

1. REPUBLIC NATIONAL BANK BUILDING—Medium pressure steam returns; hot and cold water lines 4" and over; soil, waste and vents 2½" and smaller. Architects: Harrison and Abramovitz, New York. Associate Architects: Grayson Gill and George F. Harrell, Dallas. Engineers: Jaros, Baum & Bolles, New York, and Zumwalt and Vinther, Dallas.

2. FIDELITY UNION LIFE INSURANCE CO. BLDG.—Fire lines, air conditioning condenser and chilled water lines, and hot and cold plumbing lines over 2". Architect and Engineer: Wyatt C. Hedrick, Dallas.

3. EMPLOYERS INSURANCE BUILDING—Downspouts, steam returns, air conditioning condenser water lines, vents 2" and smaller. Architect and Engineer: George L. Dahl, Dallas.

4. CORRIGAN TOWER—Downspouts, fire lines, and condenser and chilled water lines 2" and larger in air conditioning system. Architect and Engineer: Wyatt C. Hedrick, Dallas.

5. DALLAS MORNING NEWS BUILDING—Steam returns, downspouts, vents 2" and smaller, condenser water lines in air conditioning system. Architect and Engineer: George L. Dahl, Dallas.

6. RIO GRANDE NATIONAL LIFE BUILDING—Air conditioning condenser water lines. Architects: Grayson Gill and George F. Harrell, Dallas. Engineers: Zumwalt and Vinther, Dallas.

7. ADOLPHUS HOTEL ADDITION—Fire lines, downspouts, and air conditioning condenser water lines. Architect and Engineer: Wyatt C. Hedrick, Dallas.

8. GIBRALTAR LIFE BUILDING—Steam returns, gas lines, downspouts. Architects and Engineers: Thomas, Jameson & Merrill, Dallas. Mechanical Engineers: Landauer, Guerrero and Shafer, Dallas.

Every one of these services carries a corrosive threat—and every one represents a time-tried genuine wrought iron application. The reason for the unusual durability of genuine wrought iron comes from its unique composition. Tiny threads of glass-like silicate slag, threaded through the body of high-purity iron, halt and disperse attack, and so discourage local pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

You'll find some helpful information in our bulletin, WROUGHT IRON FOR PIPING SYSTEMS. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

(1) Public construction sponsored by states, municipalities and other public bodies, including public water works, whether publicly or privately owned (excluding schools, hospitals and public roads where housing and other types of construction control has been delegated to other agencies).

(2) Commercial construction such as office buildings, stores, service facilities, warehouses (excluding operating construction for communications facilities, subject to Order M-77), radio and television facilities, public utilities (except those items subject to Order M-50 (power plants), and similar types of construction).

(3) Construction for religious purposes.

The criteria also discuss construction that already has been started. NPA said it will give special consideration in making allotments where the failure to finish commenced construction would be uneconomical or would cause loss or waste of materials, or where completion is in the public interest.

CMP Transition Painful

The fourth quarter of 1951 promises to be a tough one for metals users who are now required to come into the Controlled Materials Plan after being assured that they would have no difficulty in operating via the open market. When CMP became effective on July 1, it was to be an open-end affair. Defense production was to operate within the closed area, with civilian production in the larger "open" area. CMP had hardly become effective before it became apparent—at least to Washington planners—that if the requests of the defense program were granted in full, there would be all too little materials left for production of consumer durables.

So, effective October 1, CMP is a closed-end affair, with every metal user presumably thereunder. To effect the transition with some degree of smoothness, NPA issued on August 21, seven directions to CMP and to steel, copper, and aluminum regulations.

NPA explained that the action, together with allotments being made for them, will permit persons previously operating in the "free area" to obtain supplies of steel, copper and aluminum in the fourth quarter by placing ACM (authorized controlled materials) orders. Suppliers would fill these orders from materials directed by NPA to be reserved for that purpose.

Direction 3 to CMP Reg. 3 was one of the most important of the orders issued by NPA to effect the transition. It was intended to restore and maintain producer-customer relationships as far as possible. Until September 10, 1951, the new direction permitted equal preference status to both unrated and authorized controlled materials orders accepted by steel, copper and aluminum producers for delivery in the fourth quarter.

After September 10, preference will be given to authorized controlled materials orders. The only exception is those orders placed by NPA directives. Producers are directed to cancel unrated orders which have not been converted to authorized controlled materials orders by September 10.

It is anticipated that there will be a hectic scramble as thousands of buyers of steel, copper and aluminum suddenly realize that ordering is no longer a question of calling up to say, "send it over." NPA is directing producers to set aside small quantities of products for late-filers. It is not to be expected, however, that the transition from free enterprise to buying-by-directive can be accomplished overnight. It is to be hoped that the first quarter of 1952 will not be as hectic for manufacturers as the fourth quarter of this year promises to be.

Petroleum Capacity Checked

Crude oil productive capacity in the United States can be increased from the current 6.8 million barrels a day to 8 million barrels daily in 1955, it is estimated by Deputy Petroleum Administrator Bruce K. Brown. The forecasts assume that drilling will continue at about the current level and that about 43,400 wells can and will be completed yearly for the next five years.

PAD (Petroleum Administration for Defense) is particularly proud of the estimate for 1955 because that figure was reached, approximately, by half a dozen forecasting methods.

"The relatively small difference between these forecasts, each made by a different method, is remarkable," said Mr. Brown. "Because of this, I believe PAD is on solid ground in using these forecasts in its mobilization planning."

Meanwhile, PAD is encouraging oil field operators to continue their exploratory work and is easing the way for the purchase of oil field supplies. Most recent step in this direction is the issuance of new forms designed to simplify the reporting of information needed by PAD to appraise properly the operator's request for casing, tubing or drill pipe.

Natural Gas Service Limited

The Petroleum Administration for Defense, through PAD Order No. 2, effective August 22 in 15 states and the District of Columbia, prohibits extension of natural gas to new large-volume consumers and to any central space-heating customers, except under specified circumstances.

The Order may later be extended to other states. At present it affects: Connecticut; Delaware; District of Columbia; Kentucky (only those portions served with gas supplied by a subsidiary of The Columbia Gas System, Inc., or by Louisville Gas & Electric Co.); Maryland; Massachusetts; Michigan; New Hampshire; New Jersey; New York; Ohio; Pennsylvania; Rhode Island; Virginia; West Virginia (only those portions served with gas supplied by a subsidiary of The Columbia Gas System, Inc.); Wisconsin.

Oil Burner Standardization?

A possible standardization of oil burner models, to save critical materials, has been discussed by NPA and members of the Oil Burner Industry Advisory Committee. NPA also advised members of the committee, at a recent meeting, to apply directly to the appropriate NPA industry division whenever mills are unable to supply materials for their authorized production schedules under CMP.

BRIEFLY STATED

• Donald C. Minard, 48, has been elected president of the Trane Company. Rueben N. Trane, 64, founder and president since the company was organized in 1913, was advanced to the new post of chairman of the board. He will remain active in the management, guiding engineering and product development. Mr. Minard has been serving as executive vice president for the past six years. The new president joined Trane as a member of the first post-graduate engineering class in 1925. After two years as manager in Buffalo, Mr. Minard entered the home office, serving successively as manager of heating sales and sales manager. He was elected a vice president in 1936, a director in 1944, and executive vice president in 1945.

• Appointment of Paul B. Holmes of Washington, D. C., as assistant director of the Building Materials Division, with supervision over plumbing and heating matters, has been announced by the National Production Authority, U. S. Department of Commerce. Mr. Holmes during most of his business career has been associated with the National Radiator Co., Johnstown, Pa. From 1948 until the time of his NPA appointment he was owner of Paul B. Holmes and Co. of Washington, manufacturers' agent for a number of producers of plumbing and heating supplies. His sons now manage the company.

• One hundred engineers interested in heat insulation have organized the Thermal Insulation Society. The first president is W. H. Zane, duPont Company engineer and vice-chairman of the A.S.T.M. C-16 committee on insulation specifications. This new group meets once a month at the Franklin Institute of Philadelphia to discuss common problems and to hear an outstanding speaker on some specific insulation material. Membership is open to those interested in insulation from the manufacturing, application, specification, distribution and end use viewpoint.

• Criteria for testing alternate and substitute materials that may be used instead of metals and other critical materials in plumbing installations are to be developed at the University of Maryland under the research program of the Housing and Home Finance Agency. The study will include a comprehensive analysis of the stresses to which all segments of the drainage and vent system are subjected.

• Rheem Manufacturing Company is purchasing a controlling interest in the outstanding capital stock of the James Graham Manufacturing Co. of Newark, California, sixty-nine-year-old manufacturers of the well known "Wedgewood" line of gas ranges. The business will continue under the management of Clarence Graham, Sr., son of the founder. Last November the Rheem Company acquired exclusive rights to manufacture and develop a new gas-absorption type of household refrigerator which is now being field-tested prior to quantity manufacture.

• Delworth Homes, Inc., a new housing project in Freeport, Long Island, N. Y., is offering year-round comfort air conditioning for its $12,000 price range seven-room basement and garage homes at a cost so low that builder Harold Bell is quoted as saying that the monthly amortization rate as part of the house mortgage would be about what the average smoker spends per week on his cigarettes. Harry Schwindt, distributor for York Corp., added that maintenance costs are actually no greater than those of the modern home refrigerator. The new air conditioner is a one horsepower model manufactured by York. At the Freeport project total costs, including freight and all installation charges, for this type of system are $750.00, Bell said.

• Battelle Institute, industrial research foundation, will establish a European branch of its laboratories to serve the European economy. The decision follows a recently completed survey of scientific and industrial conditions in Europe. Exact location of the European branch and other details will depend upon the outcome of negotiations now in progress. It is anticipated, however, that the new service will be in operation early next year.

• The Office of Price Stabilization acted July 25 to help relieve the copper shortage by permitting sales at 27½ cents a pound of certain quantities of refined copper by refiners using imported raw materials. The ceiling price for the basic domestic grade of electrolytic refined copper remains at 24½ cents, Connecticut Valley. No action to change that figure is contemplated at this time, OPS said.

• Warden N. Hartman has been appointed manager of the industrial insulation department of the Armstrong Cork Co. James W. Liddell has been named manager of high-temperature insulation products, succeeding F. W. Muller who has resigned.

• Thatcher Furnace Co., Garwood, N. J., announces the appointment of G. J. Caharack as advertising manager. Before joining Thatcher, Mr. Caharack was with the advertising and public relations division of Underwood Corp., New York, N. Y.

• John A. Gilbreath, formerly sales manager of the air conditioning division of Servel, Inc., has been named assistant vice president in charge of the divison. Other new appointments include: John K. Knighton, vice president in charge of sales; A. F. Scharer, vice president in charge of the international division; F. W. Ortman, Jr., vice president in charge of personnel; S. L. Nicholson, vice president in charge of purchasing; and Rudolph Schnakenburg, vice president in charge of finance. Mr. Schnakenburg retains his post as secretary. N. J. Litherland was named treasurer, a post relinquished by Mr. Schnakenburg, and W. E. Baker, vice president in charge of manufacturing, was named to the additional post of assistant to the president. O. J. Dail, up to now general manager of the commercial electric refrigeration division, becomes assistant vice president in charge of that division.

DON'T HEAT THE GROUND UNDER THE BUILDING!

WHERE RADIANT HEATING operates upward from an uninsulated GROUND FLOOR the loss of heat downwards by straight conduction through solids is substantial.

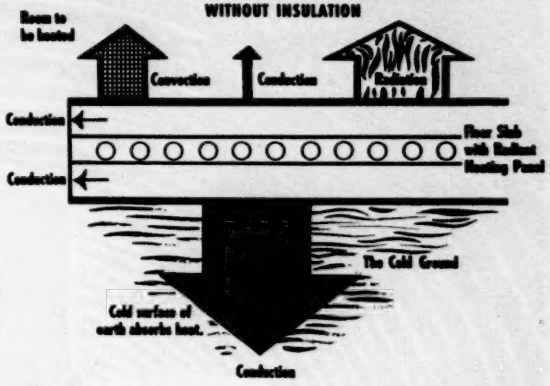
Heat by conduction follows the law that warmth flows to cold, never the reverse; in any direction, down and sideways, as well as up.

Since the ground is colder and more massive than the space above the floor, there will be considerable flow of heat to the earth below as well as the floor above.

The GUIDE of the Amer. Society of Heating and Ventilating Engineers says, *"When the heating pipes are imbedded in a concrete floor slab a portion of the heat emitted by the pipes will flow upward into the space to be heated, and the remainder will flow downward into the ground.*

"When the heating pipes are placed below the concrete floor slab instead of being imbedded in the slab, a larger portion of the heat will flow into the ground, and a smaller portion into the space to be heated."

Heat Flow from Floor Radiant Heating Panel
WITHOUT INSULATION



COLD AREA

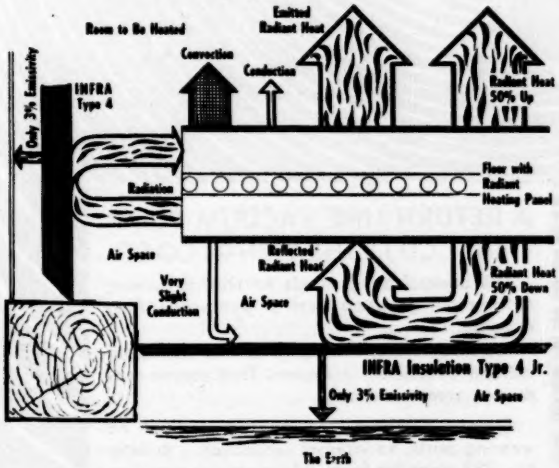
The National Research Council of Canada recently conducted numerous tests and found that without insulation under ground floor radiant panels, heat flow *into* the earth was preponderant; in considerable amounts to 6 ft. underground, and extending in lesser amounts to 12 ft.

By installing multiple accordion aluminum with assured air spaces, under the heating panel, MOST of the dissipated heat would be saved for radiant heating, because 95% of CONDUCTION to the earth would be stopped by the air spaces, and RADIATION loss would be only 3%. There is NO CONVECTION downwards.

Six-space and 4 space multiple accordion aluminum have C factors for downheat flow of .044 and .065 respectively, equal to 9" and 6" laboratory dry rockwool. They are non-condensation forming, of zero vapor permeability.

Insulation in relation to radiant heating, with a new technique for floor slabs, is discussed in Infra's new 1951 "Simplified Physics of Vapor and Thermal Insulation," a complete and concise manual mailed free on request.

Heat Flow from Floor Radiant Heating Panel
WITH INFRA INSULATION



INFRA THERMAL FACTORS, DOWNHEAT FLOW

Type 6	C.044 R22.72 equals 9" DRY Rockwool
Type 4	C.065 R15.38 equals 6" DRY Rockwool
Type 4 Jr.*	C.097 R10.30 equals 4 ½" DRY Rockwool

*In 1" Space

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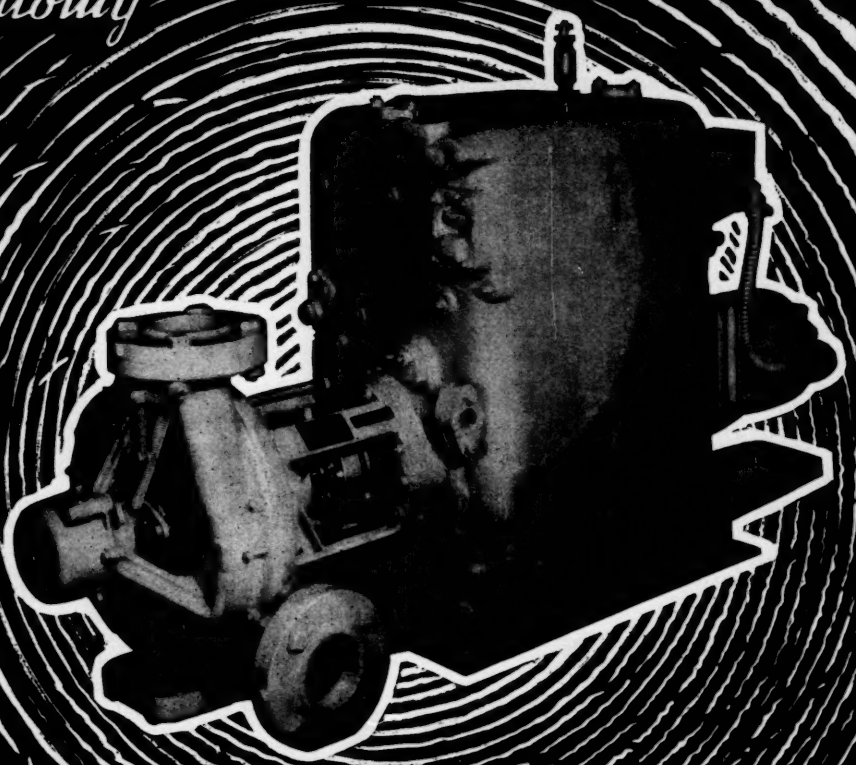
Centralized Heating Economy



A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

Selection, Operation and Maintenance of Industrial Cooling Equipment

HOWARD E. DEGLER

Technical Director, The Marley Co., Inc., Kansas City, Kansas.

HEADLINES of water crises in New York City and elsewhere have brought to public attention water shortages that engineers have predicted for years. Conservation and reuse of water have become necessary in many areas. Water can be purified, cooled, and reused again and again.

In general, water shortage has nothing to do with drought but can be attributed to overpopulation in cities and increased industrial and agricultural requirements. USA requirements are 100 billion gallons per day for everything from drinking and irrigation to making steel, comfort cooling, and watering the lawn; that is 700 gallons per day per person.

The unsuspecting housewife and the indifferent businessman have teamed up with the many industrial users to make water the Nation's most precious natural resource. Like the automobile and radio, ample water is part of the American way of life. Most people are surprised to learn that our water supply is exhaustible, and like coal and oil you can take water from the ground faster than nature can replenish it.

Tremendous accumulated quantities of underground water are approaching depletion in some areas because of seasonal over-pumping. Surface water from rivers and lakes is also approaching depletion during drought and high-temperature summer periods. As the frontiers of our country were extended, the clearing of lands increased the water run-off from rainfall and further decreased the underground water supplies.

Cooling Water Requirements

The irrigation of one acre of oranges requires 800,000 gal of water per wetting. Producing one kilowatt of electric power takes 2,000 to 3,000 gal per day; making one ton of ice takes 6,000 gal per day. The midsummer cooling of a large theater requires 80,000 gal per day. One large paper mill uses 25 million gpd, more than the total water pumped for the domestic and industrial use of a city of 200,000 population.

Many processes require huge quantities of cooling water; Table 1 lists 15 specific examples.

Great as the total water requirements are, they are much less than the total amount of rainfall and less than the smaller amount available for use from streams and underground sources. However, the availability is continuously decreasing and the need for water conservation and regulation becomes increasingly imminent.

TABLE 1—COOLING WATER REQUIREMENTS FOR TYPICAL APPLICATIONS.

Product	Pounds of Water per Pound of Product
Air conditioning	100 (per person/hr)
Aluminum	500
Atomic energy	Huge quantities
Food processing and storage	100
Gun powder	400
Hydrogen	2,500
Lactose	800
Oil refining	500
Paper	200
Power	750 (per kwh)
Rayon	800
Refrigeration	1,500 (per Ton/hr)
Rubber (Synthetic GR-S)	2,500
Steel	250
Sugar	100

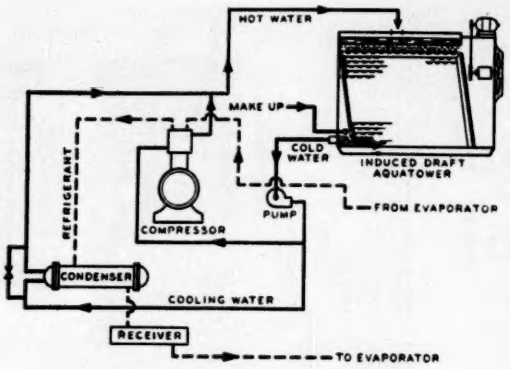


Fig. 1. Typical flow diagram of cooling water for refrigeration system.

In general, the quantity and temperature of water available are of the utmost importance, far outweighing considerations of quality. But the quality of water supply cannot be ignored because dissolved solids, gases, and other impurities may corrode or foul metal surfaces.

Cooling Methods for Water Reuse

Once-through use of cooling water is wasteful. In many applications the same water can be used for additional service and/or continuous reuse. Selection of the most economical water-cooling method becomes more important as demands increase and the many varied processes expand their water usage.

During the past 40 years the progressive improvement of methods for cooling and subsequent reuse of water have been utilized in the following sequence: (1) rivers, lakes, wells, and cooling ponds, (2) spray ponds, (3) evaporative condensers, (4) natural-draft water-cooling towers, (5) forced-draft cooling towers, (6) induced-draft cooling towers, and (7) dry-surface coolers (air-cooled exchangers).

Previous to the year 1920 large water-cooling systems were used only with steam-electric generating stations, usually located on the banks of rivers, lakes, or artificial cooling ponds. In some installations it was expedient to use spray ponds. Refrigeration and ice-making constituted the second largest usage, with roof-located natural-draft towers and spray ponds.

Since 1920, numerous new applications have arisen, and requirements have become increasingly varied and exacting, necessitating refinements and specialized adaptations of water-cooling equipment. The principal demand for large water-cooling systems in recent years has been from the petroleum industry, steam power plants, process industries, and chemical plants. Refrigeration, air conditioning, and engine-jacket cooling, each employ a large percentage of the medium-size and small cooling units installed today.

Progress of the cooling equipment industry is apparent when it is realized that for a definite need, a modern cooling unit requires only 1 sq ft of ground area as compared to 50 sq ft for the spray pond and about 1,000 sq ft for a natural cooling lake or pond. The continuous demand for a more compact design, better construction, lower cost, larger capacity, greater flexibility of operation, independence of atmospheric uncertainties, and improved all-around performance has resulted in the modern induced-draft water-cooling tower.

Principles of Evaporative Cooling

A water-cooling tower is an enclosed structure for the evaporative cooling of water by contact with moving air. Water, when cooled by the evaporative effect in a cooling tower, transfers to the air about 1,000 Btu per lb of water evaporated. In other words, 100 lb of water can be cooled 10F by the evaporation of one lb of water. Air, absorbing heat from water in this manner is capable of cooling water below the atmospheric (dry-bulb) temperature.

Theoretically, water may be cooled by the evaporative method (as in a cooling tower) until its temperature is lowered to the air's *wet-bulb* temperature. In practice, however, water is cooled to a temperature approaching the wet-bulb; the closer this approach the larger the size of the cooling equipment required for a given duty. Generally used wet-bulb design temperatures are 70 to 80F, depending upon the service and geographical location of the unit.

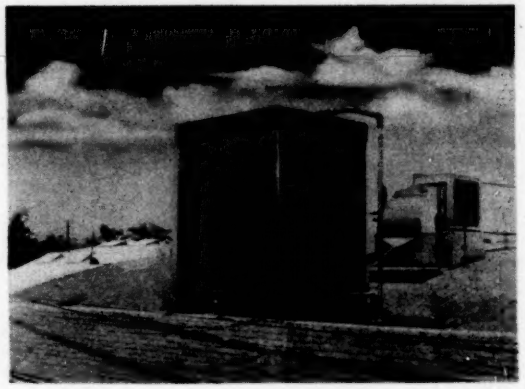


Fig. 2. Natural-draft water-cooling tower.

Cooling range is the number of degrees that the water is cooled with water-cooling equipment. It is the difference between the temperature of the hot water coming to the unit and temperature of the cold water leaving the cooling equipment.

Water-Cooling Towers

Fig. 1 shows a flow diagram for cooling the water of a typical refrigeration system with an induced-draft cooling tower. The water flow is shown by solid lines and the refrigerant path is indicated with broken lines. In Fig. 1, the water picks up heat from the refrigerant gas in the condenser. In the compressor it picks up friction heat from the piston cylinders. The hot water enters the top of the tower at 95F and leaves at about 85F, when the wet-bulb temperature of the air is 78F.

Installation photos of three common types of small cooling towers, 10 to 2,000 gpm of water, are shown in Fig. 2 and 3, and on page 65. Fig. 3 is the type pictured in the flow diagram of Fig. 1.

The natural-draft water-cooling tower, Fig. 2, is one in which the air movement through the tower is dependent solely upon atmospheric conditions. This tower, as usually built, has nozzles that spray downward from the top of the structure and the walls are slanting louvers with open air space between so the breeze can pass through freely. As the sprayed water drops toward the bottom of the tower, the air passes transversely through the tower. The quantity and velocity of the air depend primarily upon how strongly the wind is blowing. If no breeze is stirring, the transfer of heat from water to air obviously is not so rapid and steady as when there is a constant supply of fresh air sweeping through the tower.

A natural-draft tower can be used when the equipment served can tolerate a few degrees higher cold-water temperature when there is little or no wind; when the drift (spray carried out of the tower through the louvers during stiff breeze) from the tower is not objectionable to the surrounding territory; and when it can be located so that the wind will not be obstructed by buildings, trees, etc. In general, the natural-draft tower does not provide enough flexibility of operation nor sufficiently low cold-water temperatures for the exacting cooling requirements of most present-day applications.

The type of water-cooling equipment affects to a considerable extent the operating temperatures of the cooling water. Some types of equipment, such as spray ponds and natural-draft towers, that depend upon prevailing winds for cooling the water, must be built for low wind-velocity conditions, generally about three miles per hour. Such equipment is not capable of maintaining a close enough cold-water temperature approach to the wet-bulb air temperature, and correlated allowances must be made for good operation at all times under widely varying conditions. On the other hand, where mechanical-draft equipment (see Fig. 3 and 4, and page 65) is employed under similar conditions, lower operating temperatures can be continuously obtained, since a close and dependable approach to the wet-bulb air temperature is practicable.

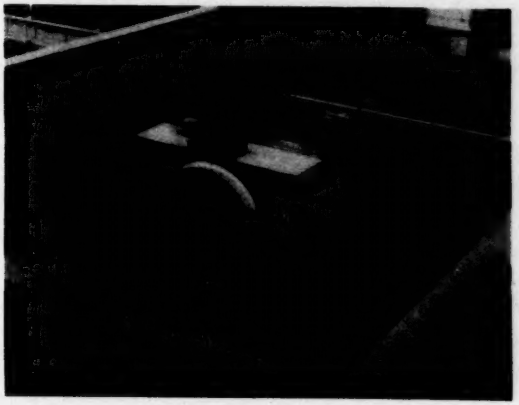


Fig. 3. Induced-draft crossflow cooling tower for small capacities, 10 to 200 gpm of water.

The mechanical-draft tower consists usually of a vertical shell constructed of redwood, metal, transite, or masonry, in which water is distributed at or near the top uniformly over the area, and falls to the collecting basin at the bottom, passing through air which is being drawn upward through the tower from louvered intakes at the bottom and exhausted at the top by induced-draft fans, as in Fig. 4.

Another induced-draft tower, developed for the purpose of obtaining more compactness, better construction, lower cost, larger capacity, increased flexibility, and improved performance, is the crossflow type (also called double-flow), Fig. 5. This distinctive tower employs multiple fans (adjustable pitch blades) centered along the top, each fan drawing air through two cells paired to the plenum chamber which is partitioned midway beneath each fan and fitted with "drift eliminators" that also turn the air upward toward the fan outlet. This tower obtains a horizontal air movement as water falls in a cascade of small drops over the wood-filling and across the air stream with low resistance to the air flow. The air travel is longer than with the conventional counterflow design, as shown in Fig. 4.

Selection of Cooling Equipment

Cooling Towers. Because of the many variables in water-cooling tower calculations and performance, it is difficult to provide simple handbook equations and tables whereby an engineer can readily select the type and size of unit for a definite water-cooling requirement.* Each manufacturer has a semi-confidential method of sizing a tower, based largely upon research and actual performance correlated with definite requirements. Selection of cooling equipment for any specified service must ultimately depend upon over-all considerations established from reliable design and performance data.

The performance of a cooling tower is improved by increasing the amount of filling, height, area, and/or air quantity. Increasing the tower height increases the length of time the air is in contact with the water, without seriously affecting the fan power required, but increases the pumping power. Increasing the tower area while maintaining constant fan power increases the air quantity somewhat and increases the time that this air is in contact with the water because of lower velocity. The surface area of water in contact with the air is increased in both cases.

Increasing the air velocity through the tower decreases the time the air is in contact with the water, but since a greater quantity is passing through, the average differential between the water temperature and wet-bulb temperature of the air is increased, but this increases the rate of heat transfer. Increased air quantities are obtained only at the expense of increased fan power, which increases approximately as

*Unreliable estimates by application engineers are frequently based upon L/G (liquid to gas ratio), gpm per sq ft plan area, hp per 100 gpm water, weight of tower per gpm of water, cooling efficiency, etc.

the cube of the air quantity. Air velocities through induced-draft towers vary from 250 to 400 fpm over the gross area of the structure; pumping heads vary from 12 to 30 ft, depending upon the design.

Air-Cooled Exchangers. The air-cooled exchanger is a device for cooling or condensing fluids by circulation of the fluid through finned tubes and forcing of atmospheric air across the coil sections. This dry-surface cooler is basically a non-contact convection type heat exchanger. One arrangement for a dry-cooler is the induced-draft unit (Fig. 6) with the fan mounted on top discharging the air upward and inducing air across a horizontal bank of coils mounted below the fan. Another arrangement is the forced-draft (Fig. 7) with the fan discharging air upward across a horizontal bank of coils mounted above the fan. Small portable units are conventionally arranged with a vertical coil-bank mounted to receive a horizontal stream of air across the coil.

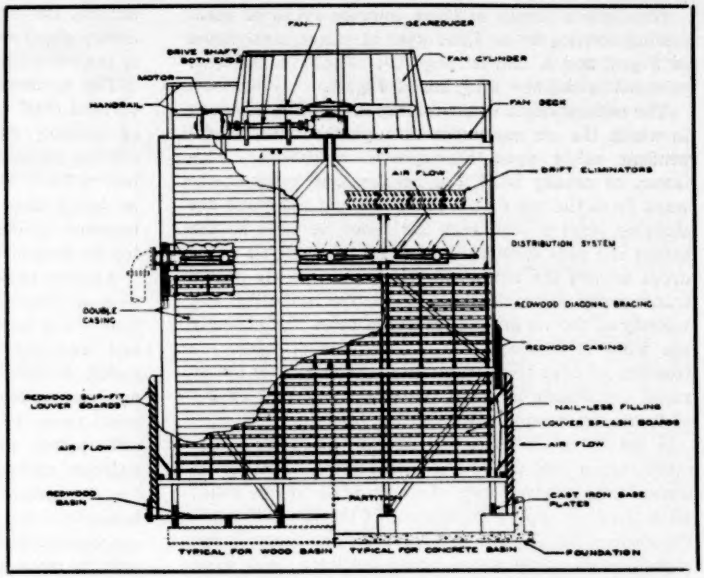


Fig. 4. Section through an induced-draft counterflow water-cooling tower.

The air-cooled exchanger may be used in preference to a water-cooling tower for applications of "high-level heat removal" where temperatures of the fluids to be cooled are about 140F, and where water is scarce, expensive, and/or badly polluted, or where the portable features are desirable. Normally, a cooling tower is more economical, but the cost of the air-cooled exchanger decreases relative to that of the tower as the temperature of the fluid-to-be-cooled rises. Both units have their own applications and in some cases either type may be used. However, a careful evaluation of both methods should be made to insure that the most suitable cooling equipment is selected in each case.

The following list shows typical applications for finned tube air-cooled units:

1. Liquid Cooling
   a. Engine (compressor) jacket water
   b. Lube oil
   c. Absorption oil
   d. Stabilized crude
   e. Vegetable oil
   f. Cotton oil
   g. Cocoanut oil
   h. Quenching oil
   i. Amine solutions
   j. Transformer oil
   k. Bearing oil
   l. Glycol solutions
2. Gas Cooling
   a. Natural gas inter-cooler
   b. Natural gas after-cooler
   c. Manufactured gas cooler
   d. High-pressure gas (booster station)
3. Vapor Cooling
   a. Gasoline
   b. Steam
   c. Still reflux
   d. Still overhead
   e. Debutanizer
   f. Depropanizer

The place of dry-surface air-cooled heat-transfer equipment should be one of increasing acceptance and usage. The basic reason for this prediction is that in spite of developments to conserve the use of water, to increase the availabiiity, and to more conveniently dispose of the heater water, all of these efforts will increase cooling costs. Hence the use of dry-surface coolers will become increasingly attractive, and more applications will be considered and made.

A process industry found it necessary to provide an additional cooling of 25,000,000 Btu per hr and could have provided additional water only at great expense because of limitations of present size of water mains and pumps. Additional heat-exchange equipment also was needed, further complicating installation problems. An air-cooled exchanger was installed; because of the self-contained feature of this type of cooler, no modifications of the utility system were required beyond the electrical connection for the fan-drive motors.

A need was evidenced to handle a cooling load existing only during winter weather. The dry-surface cooler was preferred because of small space requirements, low air temperature, simple to start, and easy control of the freezing hazard.

When selecting the design air temperature for dry-surface coolers, it is generally acceptable to choose a *dry-bulb* temperature which will not be exceeded more than 5% of the hours between noon and midnight during the months of June to September, inclusive. The temperatures that occur in excess of this design value will be of such short duration as not to have an appreciable effect on efficiency or performance. Frequently used dry-bulb design temperatures are 95 to 100F.

Operation

Pages could be written on the starting-up, operating, maintaining, and shutting down of water-cooling equipment in order to obtain maximum results under varying heat-load requirements and changing weather conditions. The life of any piece of water-cooling equip-

ment is directly dependent upon its inherent qualities, type of service, severity of operation, general care and maintenance, and climatic environment. In any event, the continued usefulness of all mechanical equipment is primarily dependent upon maintenance.

Water Treatment. Treatment of cooling water includes: prevention of corrosion and scale formation on heat-exchanger equipment; prevention and control of algae; and control of delignification* of cooling tower lumber.

The amount of make-up water required depends upon evaporation loss, drift loss, and blow-down. Evaporation losses average 0.75% of the water circulated for each 10F range. Drift loss is the water carried away by the air current in the form of droplets or mist. This loss approximates one-tenth of one percent of the water circulated.

The amount of blow-down water required depends upon the hardness of the circulating water, the type of water softener or inhibitor used, and the amount of drift loss. Blow-down is normally controlled to maintain the concentration of dissolved and scale-forming solids below the point where the formation of scale would occur or would be caused by corrosion. The total amount of solids introduced by the make-up water equals the total removed by the blow-down, hence the ratio of make-up to blow-down indicates the concentration in the system.

Scale. Some scale-forming materials are found in practically all water; however, the most troublesome are normally calcium and magnesium carbonates. Scale formation on equipment reduces heat-transfer rates. This scale can be reduced or prevented by softening the make-up water with lime and soda ash, zeolites, sulphuric acid, soluble phosphates, or sodium chromate. Regardless of the water-treatment method used, a systematic program of blow-down should be established to control the dissolved solids in the cooling water. The choice of method for water treatment is largely one of an economic nature; since it requires close regulation and control, a competent chemist should be consulted.

Algae. Algae formations may obstruct water flow and prevent proper water distribution. This growth may collect on the equipment served, reducing the heat-transfer rate. Hold algae at a minimum or eliminate it. Algae may be controlled by 1 to 10 ppm copper sulphate; it is corrosive, hence dosage must be kept low. A half to one ppm chlorine will control algae, but it is less effective as the pH increases. Excessive chlorine is corrosive and may destroy the wood.

Two-Speed Motors. For adapting performance to temporary or seasonal decreases in heat load, and especially for winter operation, two-speed motors are best for fan drives. The chief advantage is that at half speed, fans need only about 15% of their full-speed power. Especially in multi-fan units, the flexibility of two-speed motors saves power.

When fan-speed is reduced to half, the hot- and cold-water temperatures will increase 6 to 8 degrees for a given wet-bulb temperature and heat load. When the wet-bulb temperature is 10 degrees below design temperature the fan can be operated at half-speed and the design water temperature obtained for a given amount of water. For the same wet-bulb temperature and the same range (but 6 to 8 degrees higher hot- and cold-water temperatures) a tower would require approximately 60% more effective cooling area at half fan-speed than at full speed operation for a desired heat load.

Another speed consideration is that during the

*Delignification is defined as the chemical deterioration of lumber caused by the removal of the lignin binder between the wood fibers; in cooling tower lumber, delignification is generally caused by the combining of sodium carbonate from the water with the lignin and also the cellulose fibers of the wood. Sulphuric acid may be used to convert the carbonate to sulphate.

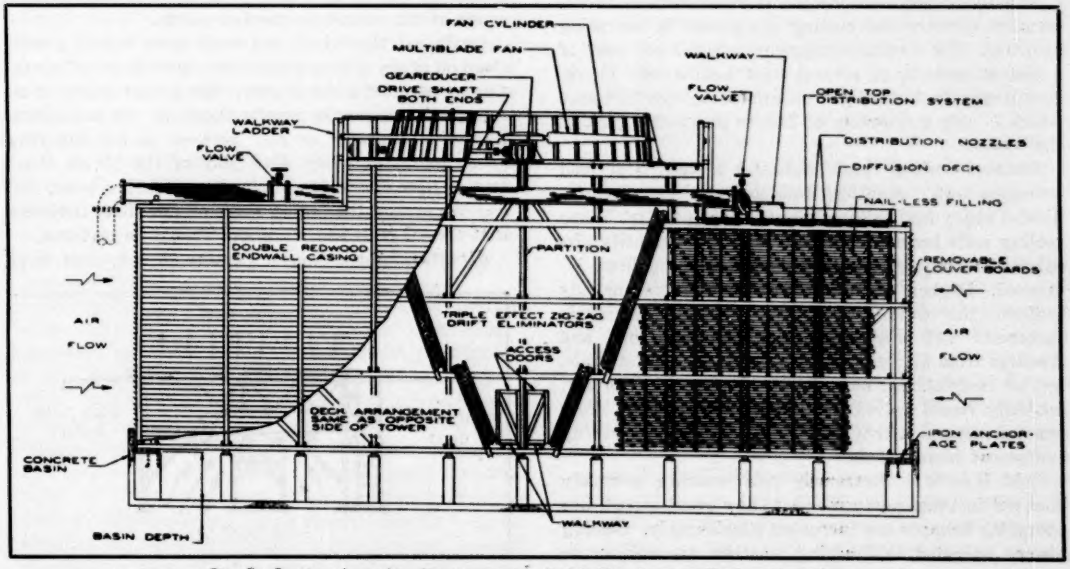


Fig. 5. Section through a large capacity double-flow (or crossflow) cooling tower.

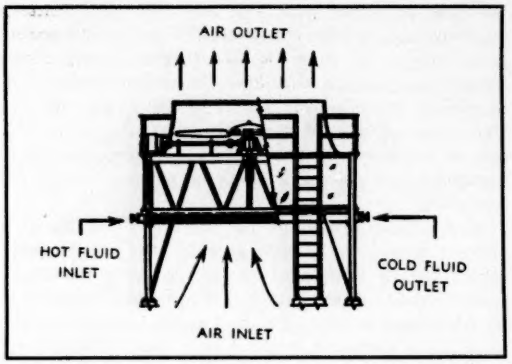


Fig. 6. Section of an induced-draft air-cooled heat exchanger.

winter months when it is not cold enough to shut down the fans completely, yet is cold enough for ice to form at full fan speed, the condition may be met readily by operating some or all of the fans at half-speed.

Maintenance

To obtain the best operating results, the distribution system, cooling coil sections, and the catch basin (under tower) must be kept free of dirt, algae, and scale. Fans driven by variable speed devices must not be operated above the speed for which they were designed. Cold water basins should be provided with double suction screens; that is, one set of screens placed in front of another so that all of the water goes through both.

Inspect oil in speed reducer weekly and add oil when necessary to maintain proper level. Drive shafts equipped with splines, gears, or universal joints should be greased weekly. Drive shafts equipped with couplings using rubber bending members do not require lubrication.

A daily inspection schedule is recommended to determine whether the cooling equipment is operating properly. The cooling equipment becomes but part of a system made up of several other auxiliaries. Therefore it may be blamed for unsatisfactory performance which is only a symptom of failure in another part of the system.

Reduced cooling range indicates a light heat load or excess water quantity. Increased cooling range indicates heavy load or insufficient water quantity. When cooling coils become badly scaled, water quantity circulated is frequently retarded and pumping head increased. Higher cooling water temperatures usually indicate this condition. Thus, if water quantity is incorrect: (1) check pump for speed, pressure, and freedom from air; (2) check heat exchanger for scale, air, or restrictions; and (3) check pipe lines for air, partially closed valves, dirt, or restrictions. A daily general inspection should be sufficient for most cooling equipment installations.

Cold Weather. Extremely cold weather normally does not increase performance to any great extent, but operating hazards are increased considerably. Cooling towers operated in freezing weather are subject to ice formation at the air inlets; small amounts of water vapor are likely to freeze on the inlet louvers and the nearby wood-filling. Ice starts to form on the lower section of louvers and progresses upwards; this accumulation of ice will restrict the inlet area and reduce the air flow, thus increasing the temperature of the water being circulated through the tower.

The main mass of the tower circulating water is rarely cooled to a temperature that even approaches freezing; in fact, the cold water temperature will seldom be lower than 60F. For this reason, ice will form only on parts of the tower that are lightly wetted by fine drops which splash toward the entering air stream.

To prevent icing during cold weather operation, one or more of the following procedures are recommended for induced-draft towers: (a) shut down fans completely but do not shut off water, this may retard ice formation; (b) cover upper portion of louvered area; and (c) shut off some of the cells.

If ice should form on the louvers and filling, one of the following methods of removal could be used: (a) reversing (for a limited time) the rotation of the motor driving the fan and thus blowing the warm air backwards and out through the louvers; (b) shut down some fans temporarily but do not shut off water; (c) cover upper portion of louvered area.

It should again be mentioned that the dry-surface air-cooled heat exchanger is particularly applicable for installations that will be subjected to severe winter operating conditions.

Mechanical Maintenance. A regular schedule should be set up for the mechanical maintenance of cooling equipment. Well maintained equipment gives the best operating results and the least over-all maintenance cost. Ball-bearing motors should be greased with an approved water-resistant grease every one to three months. Follow instructions issued by the motor manufacturer when greasing motors. Do not over-grease ball bearings, for over-greasing will cause their failure almost as quickly as under-greasing. Insulation value of the motor should be checked yearly.

Drain out the old oil and refill speed reducers with clean oil of the proper grade every 3000 hours of operation, or at least twice a year. The proper grade of oil for speed reducers is usually shown on the nameplate. Excessive clearance or play between pinion and ring gears indicates wear. End play of the pinion shaft or side play of the fan shaft shows bearing wear. Oil leaking around the pinion shaft or fan shaft indicates that the oil seals are worn and should be replaced.

Structural Maintenance. Remove all dirt, scale, bugs

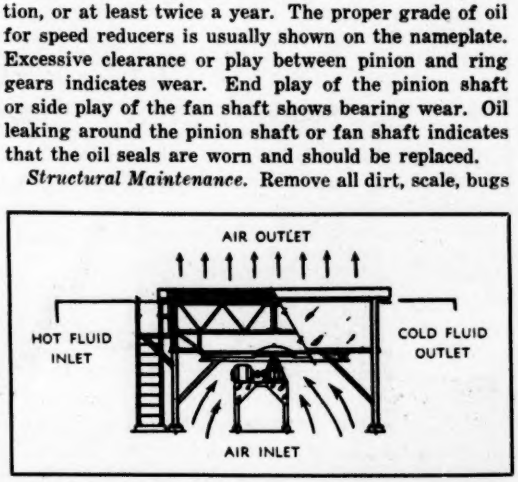


Fig. 7. Section of a forced-draft air-cooled heat exchanger.

and debris from the cooling system. Replace all damaged or missing parts. Clean and paint all corrodible metals as required. Redwood does not require protection from the weather, but in some cases it may be desirable to paint it for appearance. Tighten all loose bolts, making allowance for the swelling of wood when wet.

Drift eliminators and finned surfaces of cooling coils should be cleaned when appreciably dirty. When wood filling slats become dirty they should be cleaned. Replace broken or badly warped slats, maintaining the same "pattern" or spacing of slats both vertically and horizontally as in the original installation.

Shutting Down. When cooling equipment is shut down for an appreciable time, particularly in cold weather, it should be drained to prevent damage from freezing and corrosion. Leave the drain open to allow rain and melted snow to escape. Operate the fans for a period of approximately five minutes once a week to keep the fan shaft bearings oiled. Protect metal parts from corrosion.

Maintenance or repair work should be done while the equipment is completely shut down, if possible. This gives the best opportunity for inspection and maintenance and does not restrict the operation of any of the equipment served. A properly maintained and efficient water-cooling unit is one of the most important factors in a modern plant requiring cooling water and will greatly improve the over-all efficiency of the process involved.

Conclusion

It is impossible to formulate any set of recommendations that would definitely establish the selection of a given cooling method as being the most suitable for any particular application. The anticipated performance, operating features, and ease of maintenance of a proposed installation must be completely analyzed, and the final selection frequently becomes a matter of engineering compromise and personal preference. It is significant that, as the need for water conservation increases, the manufacturers of cooling equipment have been accumulating a great reservoir of experience by continuously making more economical units and more highly specialized applications.

Heating-Cooling Ceiling Frees Usable Office Space

The net usable space in the 30-story office building being constructed for the Aluminum Company of America in Pittsburgh will be increased by the equivalent of one and a half stories through the use of multi-purpose aluminum ceilings for heating, for partially cooling and for accomplishing the desired acoustical treatment, three engineers of the Aluminum Research Laboratories of Alcoa, declared at the July meeting of ASHVE in Portland.

In addition to panel heating, the ceiling will afford panel cooling in such a manner as to relieve the air conditioning system of a large portion of its normal load. The increase in usable space in the building will be effected through the resulting reduction in size of air handling equipment and ducts, the efficient use of ceiling area, and certain construction innovations adopted.

E. S. Howarth, chief of the metal working division, and S. C. Huddleston and R. M. Koch, research engineers, all of the Alcoa Research Laboratories, reported on the findings of tests conducted to determine the heating and cooling performance of a variety of brazed aluminum ceiling panels.

Aluminum ceiling panels offer certain advantages when compared with panels composed of water-carrying tubes embedded in plaster or concrete, the authors said. The high thermal conductivity of aluminum permits wide spacing of the water-carrying tubes and obtains a temperature of the effective face of the panel approaching that of water in the tube. Hence the temperature of the chilled water can be above the dew-point of the ambient air and still provide effective cooling. The aluminum panels respond rapidly to quick changes in water temperature and are not subject to cracking hazards. Acoustical treatment is accomplished readily with no adverse effect on thermal performance by perforating the sheet elements of the panels and overlaying them with glass wool blankets in a manner common to metal acoustic ceilings.

The engineers emphasized that although the test results reported in their paper were obtained from brazed panels, their analytical procedure was not in any way limited to that type of construction. In fact, they said, the ceiling selected for the building is being constructed of relatively small aluminum pans having integral clips which attach the pans mechanically to the water-carrying pipes. They said the theory and design developed in their tests have been applied to them with good results.

The experimental phase of the investigation involved the testing of several designs of ceiling panels, each of which, in general, consisted of a sheet of aluminum to the top of which was brazed aluminum tubing tracing a sinuous path across the panel. Most of the tests were performed on panels in which the facing sheet was ⅛ inch thick.

However, tests were also conducted on panels having facing sheet thicknesses of 3/32 and ½ inch. Five panel designs were tested in which adjacent tube passes were spaced on 8-inch centers and seven designs involved tubes spaced on 20-inch centers.

The test results indicated that, for identical water flow rates, air velocities, face sheet thickness, and surface emissivities, panels having a tube spacing of 8 inches exhibited practically the same thermal performance for 160F inlet water as did 20-inch tube space panels when the inlet water temperature was 180F. Similarly, increasing the facing sheet thickness from ⅛ inch to ½ inch nearly compensated for an increase in tube spacing from 8 to 20 inches.

Cooling and Film Drying System for a Developing Machine

JACK E. SCHECHTER* and GEORGE MARCUS†

WITH the advent of television, the rapid processing of sound track for use in Kinescope and similar applications, on a 24-hour demand basis, brought forth an interesting engineering problem pertaining to the design and installation of a cooling and drying system for a continuous developing machine.

This compact unit turns exposed film into the finished reproducible product at a rate of 100 fpm. In the developing process, Fig. 1, the film travels through a developer, hypo bath, wash tank, is sprayed with clean water, and is finally dried in an air drying cabinet. Film is continually moving along rollers, its length of immersion being controlled by the depth of submersion and therefore the time of travel in the solution. As the film is subjected to definite and invariable time of treatment, this calls for specific temperature conditions in the developing fluid and equally certain temperature and humidity conditions in the drying cabinet.

Thus, a two-fold problem is presented: (1) to provide enough dry, warm air to remove all of the wash water from 100 ft of film per minute in the drying cabinet, and (2), which is more important, to maintain the temperature of developing tanks *A* and *B* to within ½ degree of 68F. A further complication is the very distinct difference between the starting load of the system and its running load. There is the possibility that in an unconditioned room, during a hot summer week end, the liquid within tanks *A* and *B* becomes heated to about 85F. In order to allow work to begin promptly, the system should have a capacity large enough to cool the liquid in the developing tanks from 85 to 68F within 1½ hrs. During this initial cooling-down period, the drying system is not used.

Load Calculation

There are 2,400 frames of film moving through the dryer per minute, and each frame will hold 0.27 grains of moisture totaling 650 grains of water per minute to be removed by the drying system. The temperature for the entering air is to be held at 85F D.B. and 69F W.B., which are the best conditions for warmth and dryness that can be maintained without damage to the film. To make sure of an adequate water pick-up, and to maintain fairly constant conditions, air quantities of about 2,000 cfm should be used for the drying air. While at first glance this may call for an oversized and, therefore, uneconomically designed system, later considerations will show that the size of the system could be no smaller under any conditions.

To wring this amount of moisture out of the air used, the air has to be cooled to 62F dew point, requiring the removal of 49,000 Btu per hr. To reheat the 2,000 cfm will naturally require an equal amount of heat to be supplied by a hot water heating coil. Now consider the load required to cool the liquid in the developing tanks from 85 to 68F. As the specific heat of the developing fluid is the same as that of water, and as the known capacity of the two tanks is 375 and 250 gal, respectively, it is no problem to calculate that the load on system No. 1 is 53,000 Btu per 1½ hrs or 35,500 Btu per hr. On No. 2 it is 38,900 Btu per 1½ hrs; 23,600 Btu per hr. Total is 59,100 Btu per hr.

The running load of the developing tanks is perhaps the most difficult to assess. There are mainly two heat producing items as (1) the pumps circulating the developing medium, and (2) radiation from the room. Tanks *A* and *B* each have a 2½ hp circulating pump. Thus, there are 2.5 × 2,500 or 6,250 Btu per hr pump load for each tank. For sake of rough assumption, all work is translated into heat. Added to this is the radiation load. With the room at 90F there is a 22F temperature difference. Each tank has a surface of about 100 sq ft and there is a heat transfer about 1,400 Btu per hr per tank. The total running load therefore is about 7,650 Btu per hr per tank.

On checking the results of these calculations, two outstanding results are found: (1) the load to cool off the liquid after a hot week end is 59,100 Btu per hr; (2) the combined running load per tank and dryer is 49,000 + 7,650 or 56,650 Btu per hr for each tank. In operation, only one tank is used at a time.

All figures shown in calculations have been rounded out for clarity and are of slide-rule accuracy.

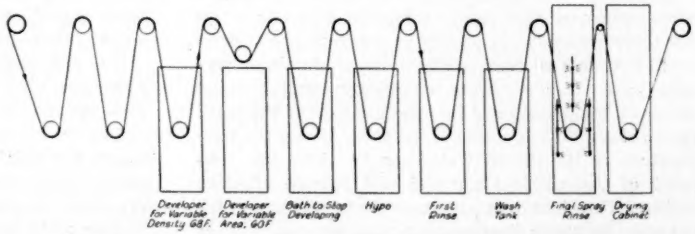


Fig. 1. Diagram of film travel through the various solutions and washes.

*Chief Engineer, James H. Martin, Inc., New York, N. Y.
†Engineer with the same company.

Equipment and Arrangement

A choice then arose between a direct expansion or chilled water system. After some consideration, it was found that uniform control in the developing tanks would be too difficult with direct expansion coils right in the unit, as there would be a definite tendency for cold spots. An economic study showed that the price of a system involving chilled water would be no higher than a direct expansion system, as the direct expansion system will require too many non-standard items. Thus, it was decided to use a 7½-ton compressor in conjunction with a dry expansion type chiller and chilled water pump circulating 55 gpm at 45F for this type of machine.

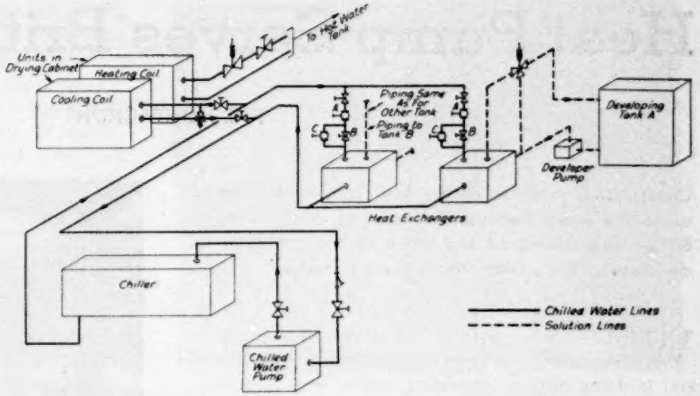


Fig. 2. Arrangement of pipe to the various components of the system.

At all times it had been a prime point to maintain close control in the developing tanks. One of the job conditions were that 60 gpm of developing fluid was to be circulated in stainless steel piping to help agitate the fluid in each tank. This proved to be the natural place for heat exchange and control. The only problem left was that of a heat exchanger. As the load varies from 35,000 to 7,000 Btu per hr per tank, a shell and tube heat exchanger was chosen, for it would not only give perfect counterflow and make cleaning very easy, but it would allow a wide range of liquid velocity and still give good heat transfer.

The temperature control is centered about these heat exchangers. On the developing fluid side is the three-way mixing valve which controls the amount of circulating developing fluid that is to be cooled in the heat exchangers. The mixing valve is controlled by an electronic recording controller which is sensitive to a 0.1F change. The mixing valves are stainless steel, as is all the equipment in contact with the developing fluid. It was decided not to control through the chilled water side as this would create too much of a time lag. However, on the chilled water side, a simple by-pass arrangement of globe valves permits settings for two definite amounts for the two prime conditions of running and start-up.

This by-pass arrangement is shown in Fig. 2. On closing *B* and opening the valve to the dryer coils, globe valve *C* on the ¾-inch by-pass controls the amount of chilled water entering the heat exchangers. Globe valve *C* is a lock shield valve and should always be open.

Automatic Controls

The automatic controls involved may be divided into three separate groups: (1) the refrigerant cycle control, which regulates the temperature of the chilled water; (2) the film dryer controls, which govern the dew point and temperature of the drying air; (3) the close controls for the two heat exchangers, which control the temperature of the developing fluid. The refrigerant cycle controls are standard and operate the compressor on a pump-down cycle. The drying air temperature and humidity are controlled by two automatic valves, one each in the chilled water line and the hot water line to the reheating coil. The chilled water three-way valve is positioned by a dew point temperature controller inserted immediately after the cooling coil which maintains a temperature there of 62F. The reheat hot water is controlled by a similar instrument in the drying air stream which maintains the temperature of this air at 85F. These two control cycles are quite of the usual variety and operate simply and effectively. The most sensitive part of the job is the pneumatic-electronic control system employed in maintaining the temperature of the developer within 0.5 deg of 68F.

The controls here operate a three-way mixing valve which allows all or part of the circulating developing fluid to flow through the heat exchanger, while recirculating respectively none of the remaining liquid, thus allowing fine control of the temperature. These mixing valves (there is a separate system for each heat exchanger) are operated by air-operated diaphragm motors which are controlled as follows:

On a rise in temperature, a thermocouple located in the fluid line leaving the developing tank will cause the indicating and controlling recorder to reset a submaster controller in the entering developing fluid to a lower control point. On a rise in temperature at this point, the mixing valve will allow more fluid to pass through the cooler, thus reducing the temperature of the circulating developing fluid. On a reverse indication the action, of course, will also be in reverse. This provides close control with a minimum of time lag.

Results

Operation of this system has been highly satisfactory. After a few minor adjustments, all required results were not only achieved but bettered. The drying system, for example, was found to be somewhat over-designed, as the film was dry after it had traversed 75% of the drying cabinet. This presents no problem though, as the client prefers to have the film in a very dry condition.

Heat Pump Serves British Festival

P. E. MONTAGNON*

Outstanding features of the heat pump installed to serve the Royal Festival Hall, part of the Festival of Britain, are described and some of the problems in developing the system to its present stage.

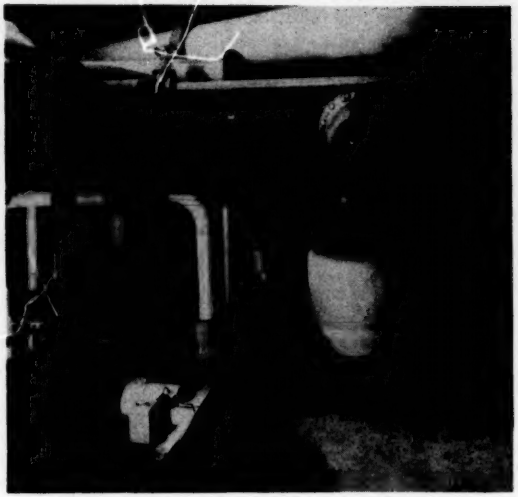
WHAT is believed to be the largest heat pump in the world is on show at the Festival of Britain and is doing duty in providing winter heat and summer cooling to the vast, modern Royal Festival Hall. It represents a large-scale experiment by the Ministry of Fuel and Power in the efficient use of fuel. The design, development and erection of the whole plant are the result of 2½ years' intensive collaboration between three engineering firms working directly under the supervision of the Ministry's scientific staff.

The purpose of the experiment is (1) to see whether the technical problems associated with this special design could be overcome, and (2) to assess the true economic merits of this method of heating a building compared with more conventional methods. The first part of the experiment has been successfully completed. The second part must await the analysis of the year's operating results.

Originally it was intended to heat the Royal Festival Hall by a hot water system with gas as the fuel. It was decided to use gas to provide power for the heat pump and to utilize as much of the waste heat from the gas engines as possible.

The winter peak heating load in the concert hall was expected to be about 250 therms per hour (therm = 100,000 Btu) with a daily peak in cold weather about 180 therms per hour. It was decided the gas engine for the heat pump should be about 700 bhp if it is to carry a good proportion of the load. But a gas engine of this rating, and a compressor to match, would be quite large. Therefore, it was decided to try high speed gas engines and centrifugal compressors. The final arrangement is a two-stage compression system, each stage being a centrifugal compressor powered by a surplus Rolls Royce Merlin aircraft engine adapted to run by the town's gas. On test, the engines obtained 30% thermal efficiency. A 7—1 gear ratio increases the engine speeds of 2,500 rpm to compressors speeds of 18,000 rpm. The rest of the plant is orthodox in design. Freon-12 is used.

Before describing the various parts of the plant, it is well to examine how the heat pump ties in with the conventional boiler system in the Royal Festival Hall itself. These boilers, thermostatically controlled, deliver water up to 180F through a series of pumps to supply the various heating services in the building. The return flow from these sources collects in one manifold which feeds the water back to the boilers. The heat pump takes water from this return header, and, after heating it, pumps it back into the main boiler feed. When the heat pump is working, less gas is burned under the boilers.



General view of the completed installation with second stage compressor shown in left foreground.

Water Circuit

Water is drawn from about midstream of the Thames River. The flow at full speed, which depends on the state of the tide, may be up to 2,000 gpm. Because of the wide variation in tide level, the pump is mounted on a platform above high water level and has a long suction line at low tide. It is assisted by a small submerged priming pump when necessary. Water flows directly to the evaporator and is returned to the river.

Water from the concert hall is led through a more complex circuit. The main flow is through a shell and tube condenser with water running through the tubes, but so arranged with a small set of shells and tubes at the bottom, that these small shells act as supercoolers for the condensed Freon. The main water flow passes from the condenser to the waste heat boiler where it absorbs as much heat as possible from the exhaust gas. The main flow is tapped to provide cooling for the engine jackets and oil systems. However, the oil cooling loop is taken from the main stream before it enters the condenser, while the engine jacket coolant is taken after the main flow has passed the condenser. This ensures that the water in the condenser is as cool as is practicable, thus giving the heat

*Author is a member of the Chief Scientists' Division of Britain's Ministry of Fuel and Power. He supervised the design, development and installation of the heat pump described.

pump the greatest possible theoretical efficiency. Each engine and compressor unit has three oil systems—for engine, gear-box and compressor bearing (and seal) lubrication. This involves three separate heat exchangers on each unit served by the same water flow line. Centrifugal pumps, belt driven from each engine, pump the cooling water round each of these oil heat exchangers. Belt driven pumps were chosen not only for reliability, but because "waste heat" from the power necessary to run them, could be absorbed in the system. The engine jacket coolant is circulated by pumps on the engines.

The main water flow, after leaving the waste heat boiler, returns to the concert hall boiler house through a centrifugal pump, driven from the first stage engine. The design flow is about 480 gpm.

The compressors are designed for about 25 lb per second of refrigerant vapor and while this is not excessive for this type of compressor, it represents a very high rate absorption of latent heat in the evaporator which has 6 stacks each of 3 shells. Each shell is 1 ft in diameter, about 20 ft long, and has 27 tubes. The vapor is led through a 10-inch diameter main into the first compressor, then through the second compressor, on to an oil separator where oil absorbed in passing through the compressors drips down over metal rings and can be drained off.

The hot compressed gas passes to a condenser consisting of 16 shells similar to the evaporator shells and 4 smaller shells for supercooling. The condensed gas is filtered.

Expansion of the refrigerant has been arranged in two stages, corresponding to the two stages of compression. An economizer is used in which a liquid level is maintained by a ball float operated valve. Refrigerant gas is led off from the top of the vessel back to the second stage compressor inlet. This economizer can be by-passed for certain operating conditions.

The refrigerant system has two other by-pass lines, the first cutting across from the delivery side of the second compressor to the inlet of the first stage. This line is used when the engines are idling for warming up, and when the minimum vapor flow through the compressors would, if condensed, provide too much heat for the hall. The second by-pass line cuts out the first stage compressor from the circuit.

High pressure side of plant showing oil separator, condenser, float valve and economizer.

Installing river water pump and motor on staging in river midstream.

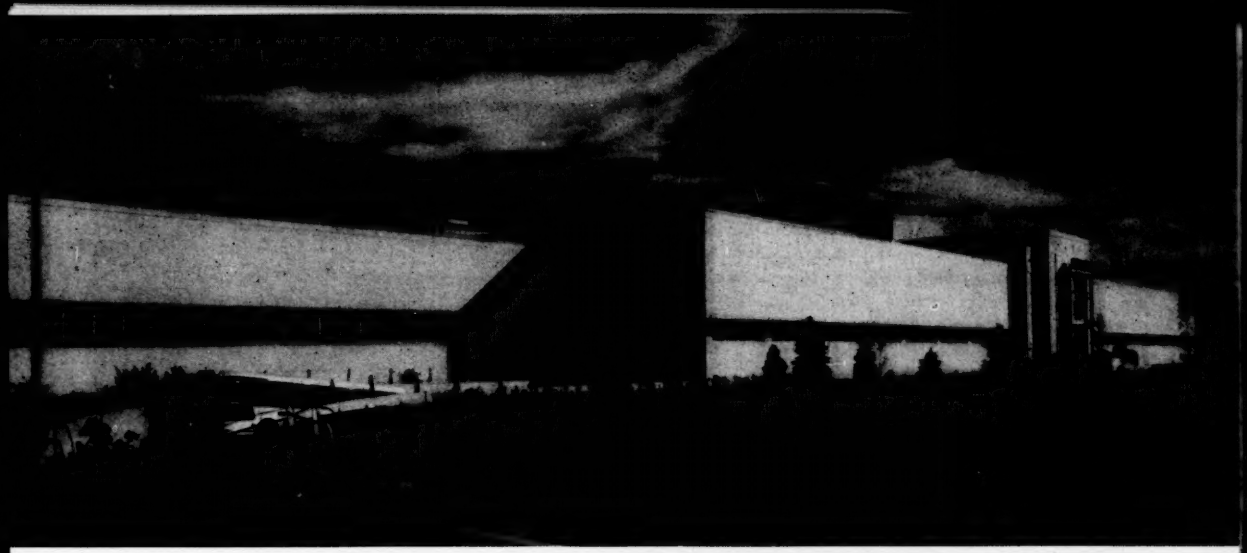
Since the plant is so novel in many ways, it was decided to arrange a simple process of taking it apart without loss of refrigerant. Therefore, two refrigerant storage vessels with liquid and vapor pumps were installed so that the system can be filled and emptied at will. Vapor pumped into the storage vessels is first cooled by an auxiliary cooler fed with river water.

The second complication is the important one of arranging the plant to supply chilled water in summer. Apart from the primary change of putting river water through the condenser, and concert hall water through the evaporator, additions had to be made to the engine and oil coolant systems, since it was undesirable to put river water through the engine jackets or waste heat boiler. During summer, the waste heat boiler runs dry, and the coolant system becomes a closed system running through an auxiliary heat exchanger fed by river water. Only treated water flows through the main engine jackets and oil coolers.

Design of the entire plant is based on a total heat output of about 90 therms per hour. Tests of the compressor system during development showed this figure could be achieved with only half the fuel consumption of conventional gas boilers delivering the same amount of heat. The plant operated for the first time early in May, 1951, when conditions were not suitable for maximum heat output. While no reliable quantitative results have yet been obtained, it is apparent that a serious loss of heat occurs from the engine exhaust manifolds. These are to be replaced by water cooled manifolds before the next heating season.

The range of operation is set by (1) the river water, which cannot be cooled below freezing, and (2) by the maximum expected temperature (140F) of the water from the concert hall.

It is much too soon to assess the economic merits of this type of plant. If the plant is to pay its way, it is necessary to have at least semi-automatic operation, so that labor charges are reduced.



New Upjohn plant on 1,500-acre site near Kalamazoo. Company buses transport employees.

Drug Maker Builds for the Future

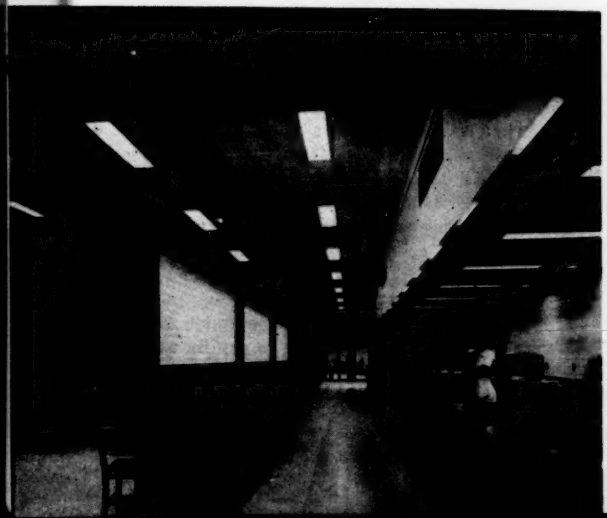
OPENING at midyear of The Upjohn Company's new pharmaceutical plant on a 1,500-acre rural site near Kalamazoo marks the completion of more than five years of planning, design and construction work. After studies of relative costs of expansion at the company's facilities downtown and at a completely new site, the contract for design and construction of the new facilities was awarded to The Austin Company in 1946.

The plant consists of a group of buildings with a total of 33 acres under roof. Except for antibiotics, which are produced in a multi-story structure required to accommodate complex processing equipment, and an adrenal cortex production unit which has been isolated in a small explosion-proof structure to cope with difficult operation conditions, all Upjohn manufacturing activities and storage are now housed on one floor in a large building 870 × 1,125 ft.

Production operations are concentrated in a 360-ft-wide air conditioned section through the center of the building, where the use of 80-ft roof trusses with 40-ft carrying trusses have made it possible to provide large areas of unobstructed floor space. Clearance of 14 ft has been maintained in all operating departments, where acoustical tile and continuous troffer lighting have been incorporated in a suspended ceiling of patented new design.

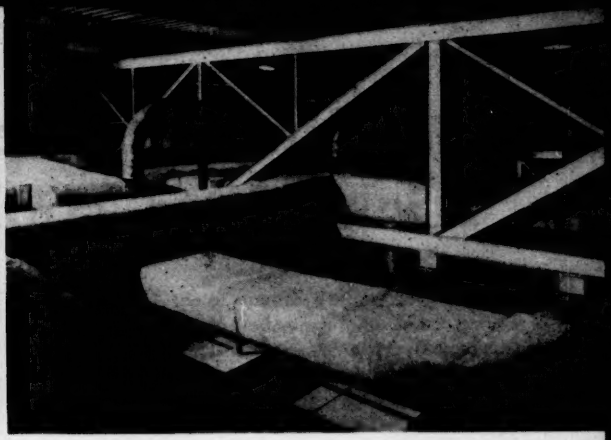
All service piping and power distribution facilities have been hung from the ceiling of a full service basement underneath the production floor. Piping and conduit are brought up by short lines through the first floor slab, directly to the points where they are needed.

Air conditioned cafeteria features 90-ft stainless steel counter, refrigerated display shelves, and electrically heated steam tables.



Visitors look through windows in corridor walls of freeze-dry area where completely sterile conditions must be maintained.

Three Carrier compressors on lower floor serve chilled water system for air conditioning. More than 1,000 tons of service piping and power conduits are hung from basement ceiling.



One of 29 air conditioning platforms in truss space above first floor. Each platform carries coils, fans, pumps and special equipment for air conditioning the zone it serves.

Approximately 25,000 knock-out pipe sleeves provided in the floor slab make it possible to rearrange or install additional production and packaging equipment, as needed.

All of the air conditioning equipment has been installed above the acoustical ceiling on reinforced concrete platforms which are supported by the welded H-section roof trusses. Because of the wide range of operating conditions and the necessity for maintaining precise control in so many different departments, 120 separate air conditioning systems were required, of which 75 are in the central manufacturing area truss space.

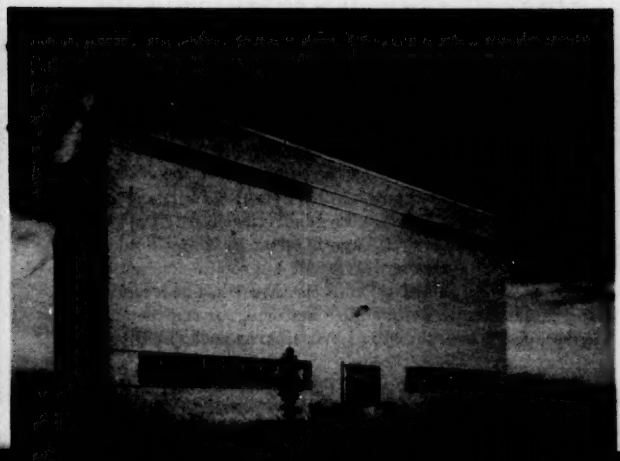
These range from simple comfort cooling units serving the service areas and production offices to highly complex combinations in which ultra-violet germicidal lamps, chemical dehumidifiers and electrostatc precipitators, have been combined with other basic equipment to meet the demand for sterile and favorable manufacturing conditions, maximum fluctuations of two degrees in temperature, and humidity ranges between 10 and 50%. Approximately 100,000 linear feet of ductwork was installed to move all the air, which is handled through 2,377 supply and exhaust outlets at a rate of 2,810,000 cfm. Conditioned air is supplied to the plant at a rate of more than 1,220,000 cfm.

Employees arriving by bus alight in a covered concourse on the lower level, at the head of a 20-ft corridor extending the full length of the plant directly beneath the center of the manufacturing area. Personnel offices, all of the employee locker and toilet rooms and three large lunchrooms have been located along the 1,125-ft length of this corridor, from which stairs at various points lead directly to an upper corridor that bisects the production floor.

The present layout provides for 50% expansion of the manufacturing building, the antibiotics and the adrenal cortex units, and there is space in the existing boiler house to double the present installation of three 750-hp three-drum boilers.

The manufacturing area is flanked on one side by a large raw material warehouse and on the other by a large finished goods warehouse, each with an enclosed railroad siding and numerous truck loading docks. The arrangement of these facilities with respect to the manufacturing area provides for progressive flow of goods in process. These warehouse areas are of monitor design with alternate 60 ft high and 40 ft low bays with columns 40 ft apart, to permit a free movement of fork lift trucks under conditions which are ideal for high pallet storage of materials and finished merchandise.

There is space for six, 750-hp, 3-drum, coal-fired boilers in this 100 x 107-ft steam plant. Three have been installed.



Three boilers are served with coal from overhead bunker. Three additional boilers can be placed at markers in floor.

Bending and Coiling Tubes of Nickel and High-Nickel Alloy

There is a wide variety of equipment for bending or coiling tubes, and a number of techniques that can be employed for such work. This article, made possible through the Development and Research Divison, The International Nickel Co., Inc., covers procedures that will give satisfactory results.

WHEN bending a tube, the elongation and compression that occurs is much the same as when bending a solid bar, but since the hollow center of the tube does not support the tube walls, the tube's tendency is to change its sectional shape by flattening or wrinkling. This tendency to flatten or wrinkle becomes more pronounced as the shape departs from a solid bar. When the ratio of outside diameter to wall thickness increases, there will be more tendency towards flattening and wrinkling. Bending equipment and procedure have been developed to offer support to the tube's wall during its bending operation, thereby mitigating the tendency to flatten or wrinkle.

Because of the variety of equipment used in various shops for making bends or coiling, it is impossible to provide a universally applicable formula for the minimum radius of bends. When absolute minimum radii must be had, these radii will necessarily be governed by the limitations of the equipment in the pipe-bending shop.

Cold bending may be done in three ways:

(1) With mechanical bending equipment without any inside mandrel or filler material.
(2) With mechanical bending equipment using an inside mandrel.
(3) With mechanical bending equipment using an easily deformed filler material, such as Tuballoy[1], Cerrobend[2], or Cerrobase[2].

Cold-drawn, annealed tube is recommended for all cold bending operations. Cold drawn, as-drawn or stress-equalized tube is suitable for hot bending operations.

The revolving-die bending machine with a stationary wiper block and a sliding guide block, where the tube is drawn away from the mandrel, is preferred to the revolving-die bending machine where the wiper block and mandrel turn with the die drawing the mandrel away from the tube. This preference also applies for the stationary-die bending machine, with or without a mandrel, where the tube is wiped around the die. The former preference exists also for bending nickel and the high-nickel alloy tube with or without an inside mandrel. The apparent reason for this preference is that the former type machine permits more uniform distribution of stresses in the tube during bending than the latter type machines.

[1]Produced by Parker Appliance Co.
[2]Produced by Cerro de Pasco Copper Corp.

Cold Bending Without Inside Mandrel or Filler

In order to support the walls of the tube and avoid wrinkling, dies used for bending annealed tubing, unfilled and without a mandrel, should be somewhat smaller than those used for bending with a mandrel or filler. This process of bending is suitable only for tube with a wall thickness not less than 1/15 or about 7% of the outside diameter of the tube. Accordingly, tube within this ratio of O.D. to wall thickness can be bent satisfactorily to a mean radius of 3 diameters or greater than the O.D. of the tube. This rule is applicable to all tube of Stub's gage wall thickness and to iron pipe sizes up to and including 2½ inches.

Cold Bending With an Inside Mandrel

Light gage tube may be bent to short radii free from wrinkles. The reduction of wall thickness on the outside of the bend is very slight. Practical experience has shown that with proper mechanical bending equipment, annealed nickel and high-nickel alloy, Monel and Inconel tube can be mandrel-bent cold to a mean radius of 2 diameters or greater, provided the wall thickness is not less than 5% of the outer diameter of the tube. For example, 1 inch O.D. tube having 0.050 inch wall can be bent to a mean radius of 2 inches. This general rule covers all tube sizes up to and including 2½ inch IPS.

Cold Bending With Aid of Fillers

The overall rule for cold bending annealed tube up to 2½-inch diameter with the aid of a filler material is expressed as follows: Tube can be bent to a mean radius of 1½ to 2 times the O.D. of the tube or greater, providing the wall thickness of the tube is not less than 5% of the O.D. of the tube. The minimum mean radius of bend for tubing larger than 2½-inch O.D. of wall thickness and not less than 5% of its O.D. should be about 4 to 5 times the O.D. of the tube.

The preferred filler materials for cold bending nickel and high-nickel alloys are the low melting point alloys such as Tuballoy, Cerrobend, Woods Metal, Cerrobase. Tuballoy and Cerrobend melt at about 160F, while Cerrobase melts at about 250F. Manufacturers of Cerrobend and Cerrobase recommend Cerrobend for tubes to 1¾ inch in diameter and Cerrobase for larger diameter tubing. These alloys shrink slightly upon solidification, which shrinkage is offset by dimensional growth at room temperature. This growth tends to assure the elimination of voids within the filled tube. Sand is not a satisfactory filler material for cold bending because it is practically impossible to pack the tube

TABLE 1 — RECOMMENDED LIMITING SERVICE TEMPERATURES* F DEGREES, FOR NICKEL AND HIGH-NICKEL ALLOYS

Material	ASME Code	Sulfur-free Atmospheres*			Steam or Steam-air Mixtures	Sulfurous Atmospheres			
						Temperature Below Which These Materials May Be Used**		Temperature Above Which These Materials Cannot Be Used	
		Oxidizing	Reducing H_2	Reducing CO		Oxidizing	Reducing	Oxidizing	Reducing
Monel	900	1,000	2,000	1,500[b]	700-800	Up to 600	Up to 500[b]	1,000	650
A-nickel	600	1,900	2,300	2,300	800-900	Up to 600	Up to 500[b]	1,000	700
Low carbon nickel	1,200	1,900	2,300	2,300	800-900	Up to 600	Up to 500[b]	1,000	700
Inconel	1,200	2,200	2,200	2,200	2,000	1,500	1,000	1,500	1,000

*These temperatures applicable for the majority of uses based on general service experience; under certain conditions materials are serviceable at higher temperatures where corrosion, oxidation, or material service life are not prime considerations. The International Nickel Company, Inc., should be consulted on specific applications.

**These materials should not be used above the recommended temperatures without consulting The International Nickel Company, Inc.
*Total sulfur content not exceeding 15-20 grains per 100 cu ft of atmosphere.
[b]Estimated.

tightly enough to prevent some cave-in during bending, which results in a kinky bent tube.

Fillers of Low-Melting Point

First the inside of the tube is cleaned thoroughly and one of its ends is closed with a wooden or a rubber plug. The tubes are filled with a light oil of low sulfur content and drained out, leaving a residual oil film on the inside wall to keep the filler from "tinning" the tube's inside diameter. When filling, the tubes should be held in a vertical position. After the tube has been filled with the molten filler, it should be immediately cooled with cold water. The preferred cooling procedure is to plunge the tube while in upright position, into a circulating water tank until completely cooled. Should there be no quenching facilities, flush or hose the filled tube with cold water, starting from the bottom and working upwards. Rapid cooling, as described, is essential to obtain a cast structure in the filler alloy possessing cold ductility most suitable for bending.

The filled tube is warmed to about 100F and is bent with slow uniform pressure over a forming block or in a conventional bending machine. After bending, the filler alloy is melted and run out of a tube by heating the filled tube in boiling water. Do not use a torch as a heating medium for melting the solidified filler material. Cerrobase can be melted by heating the tube in a hot oil bath held at about 325F. Use of a low-sulfur oil and removal of all traces of the oil from the tube's surfaces are recommended. If an oil of questionable sulfur content is used, it is mandatory that every trace be removed. Upon complete removal of the filler, the tube is flushed out thoroughly with a solvent to remove all traces of the oil with which it was filled initially. Then the tubes are cleaned with a hot (180-200F), 10 to 20% solution of trisodium phosphate or sodium carbonate followed by thorough rinsing in water to remove any film of the solvent that might have remained. Then the tubes are cleaned with a hot alkaline solution (180-200F). This solution can be prepared by adding 10 to 20% of trisodium phosphate or sodium carbonate (washing soda) to water. All cleaning operations are to be followed by several water rinses to insure a clean surface.

For cold bending, the tube may be filled with molten rosin or lead after first driving a wooden plug into the end. With lead, the tubes are first filled with an oil and the oil drained out as described. Tubes should be held as nearly vertical as possible when filling, and additional filler should be added to feed the shrinkage which develops upon solidification. Then a second wooden plug should be driven tightly against the filler and the tube be allowed to cool fully before the bend is made. After bending is completed, the filler can be remelted with torches and emptied out.

It is imperative that all traces of rosin or lead and oil used in conjunction with the lead filler be removed from inside the tube. Residue of rosin will be left in the tubes unless adequate cleaning is performed. Rosin residues may be thoroughly removed from the inside of tubes by soaking for a short period in a 25% concentration of boiling caustic soda. Rosin may become a serious fire hazard if it becomes too hot during the melting. The heating must be kept under control and watched carefully after the rosin is completely melted to prevent boiling or flash point temperatures.

Press Bending and Roll Bending

Presses equipped with wing dies are preferred. Press bends can be made through an included angle of 120 deg. Heavy wall tube such as iron pipe sizes and heavier is suitable for press bending to a mean radius of 6 times the tube diameter or greater without support given to the I.D. of the tube. Tube of wall thickness not less than 5% of its O.D., supported with a filler material, can be bent to a mean radius of 3 times the tube's diameter or greater, without the formation of wrinkles.

Limitations for roll bending with three-roll benders follow in general those previously cited for press bending. However, where 360 deg bends are to be made, the minimum mean radius of bend ought to be held to 4 times the tube's diameter.

Hot bending should be avoided on thin wall tube, if

Annealed Monel 5/8 inch tube being formed into a return bend that will be part of a heat exchanger.

possible, because thin wall tube does not retain heat sufficiently long to give good results. Hot bending should be confined to sand-filled tube, 2-inch IPS and larger. Hot bends to mean radii as short as twice the tube's diameter can be made on sand-filled tubes 2 and 2½ inch IPS. On larger diameter pipe, the radius of bend must be increased.

When hot bends must be made, cold-drawn, "as-drawn" tubing should be used to avoid excessive grain growth due to heating. Cleanliness of tubes that are to be hot bent is essential. All oil, grease, paint, chalk and other foreign material should be removed from the O.D. and I.D. surfaces with a suitable solvent. Any residue of the cleaning solvent on the surfaces of the tube should be removed by dipping or flushing the tube in a hot (180-200F), 10 to 20% solution of trisodium phosphate or sodium carbonate, followed by water rinsing.

Sand used as a filler for hot bending nickel and high-nickel alloy tubing must be sulfur-free or nearly so. Cases are on record where the use of sand, containing as low as 0.012% sulfur, embrittled the tubing at hot bending temperatures and rendered it useless. Washed and kiln-dried high-silica sand is suggested for hot bending the high-nickel materials. Residual sulfur may be burned out of sand by thinly spreading it on a plate or pan of heat-resisting alloy and exposing it to an oxidizing atmosphere at about 2,100F.

The apparent suitability of a sand with regard to its embrittling effect on the high-nickel materials can be determined by intimately exposing a small sample of the nickel material in the sand at elevated temperatures and making a bend test on the sample after it is cooled to room temperature. By bending the sample through 180 deg flat on itself and observing surface radius of the bend, sulfur embrittlement can be determined. If no minute surface cracks develop after bending, it is reasonable to assume that the sand is a suitable filler.

This on-the-job check of the sand can be made by packing a thin gage piece of pure nickel in the questionable sand. This sample, well surrounded by the sand, is then heated to about 2,000F for 10 minutes.

The hot rectangular sample should then be quenched in a water-alcohol solution containing about 2% alcohol to prevent the formation of a tenacious, continuous film of oxide on its surface which will otherwise occur if the sample is air-cooled. The surface of the quenched sample will have a grayish film of partially reduced oxide which will make inspection of the appearance of the material over the radius of the bend more convenient than if it is air-cooled and contains an adherent, black oxide film.

The tube is filled with sand after first plugging one end and tightly ramming in the fine sand that has been heated previously to drive out all moisture. The other end is plugged tightly. The filled tube is now ready for heating prior to hot bending. Thorough removal of all moisture from the sand is important before hot bending; otherwise, steam formed during heating might develop a bursting pressure.

Rod-heating furnaces, open front and back and fired with gas or oil from one or both ends, are commonly used for heating tube for hot bending. Sulfur-free fuels or fuels containing low amounts of sulfur are essential for heating nickel and the high-nickel alloys. Sulfur will embrittle these materials at elevated temperatures and render them useless. Sulfur-free natural gas is a very satisfactory fuel. Manufactured gas containing up to 15 grains total sulfur per 100 cu ft is known to be satisfactory; there are cases where manufactured gas contained upwards to 30 grains total sulfur per 100 cu ft and is found suitable. We consider this higher level of sulfur content to be marginal, however, especially if heating time is extended and the material is nickel rather than a high-nickel alloy. Fuel oil used for heating the high-nickel materials should never contain more than 0.5% sulfur; light distillates Grades 1 and 2 fuel oils (ASTM Specification D-396-39T, Fuel Oils) are suitable.

The following heating procedure is recommended:

Heat the tube as rapidly as possible, consistent with uniformity, without soaking. Keep the burner setting of the furnace on the reducing side, i.e., adjust to maintain at least 1 to 2% carbon monoxide in the combustion products. Do not permit the flames to impinge on the tube. Support the tube above the hearth of the furnace, rotating the tube frequently as it is heated. The best temperature range for hot bending nickel and Inconel is 2,250 to 1,900F, and for Monel 2,150 to 1,850F. If the furnace design does not permit keeping the wooden plugs out of the fire, that is, if the bending must be done very near the end, then a disc, preferably of the same composition as the tube, can be welded in to confine the sand. An extra allowance of ¼ to ½ inch in length should be kept closed at each end by welding to provide for disc removal.

Heating the Small Rural School

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There are still a large number of one-room schools in use in the United States. They present heating problems far different from the multi-room schools.

WHEN clanging school bells summon young America to its daily joust with the three R's, a surprisingly large number of students report to one-room schools. The Research Division of the National Education Association is authority for the statement that in 1948 (the last time a count was made) there were more than 75,000 one-room shools in the United States. In rural sections of the country the one-room school is still being used, although it is often expanded to the two- or three-room school. Indications are that it will continue to be used for a good many years to come.

Heating such schools has always presented a problem, for they are usually built in areas where the population is spread thin, and where money for schools is definitely limited. A central heating system for some of these schools is considered too costly; therefore, the conventional cast iron, pot-bellied stove is generally used.

Until recent years, the country schoolhouse depended on a cast iron, pot-bellied stove, or even some jerry-built device. Developments in floor mounted and ceiling suspended direct-fired, warm air heating systems has resulted in their use in such schools.

Direct-fired equipment has been used either as a space heater with the unit placed in the room or rooms to be heated, or installed with a minimum of duct work. There are several space heaters that are economical in heating one-room schools. Others, where ingenuity is used in positioning, can readily be used as a central heating plant, with duct take-offs to the various rooms.

Use of Direct-Fired Heater

A direct-fired space heater need heat only the building during portions of the day when school is in session. In the morning, the heater can be turned on by raising the thermostat to the desired temperature, and it can be turned down when the school session ends. It pays an extra dividend in communities where the schoolhouse doubles as a social center.

A good example of this type of installation is illustrated in Fig. 1 and 2, which show the interior and exterior of a small schoolhouse in southern Illinois. This structure contains but one room which occupies the entire building space. Lavatory facilities are of the Chic Sales vintage and are in the outhouse at the

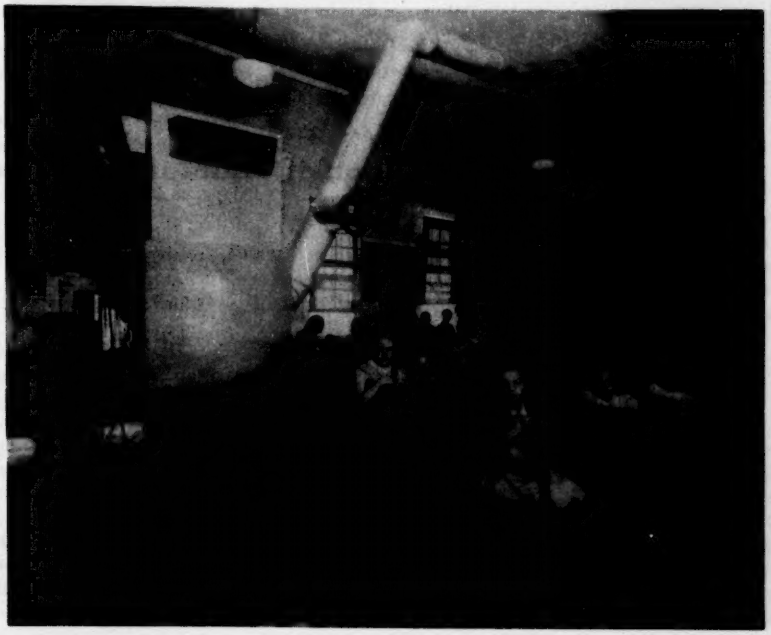


Fig. 1. This direct-fired heater replaces the traditional pot-bellied stove in a one-room school. Installation of heater resulted in more uniform temperatures

Fig. 2. A 50-year-old one-room school structure which has its counterpart in many areas.

right of Fig. 2. A coal-fired pot-bellied stove, used for many years, never furnished satisfactory heat, for room temperatures were far from uniform. The stove itself was a distinct fire hazard. Installation of a forced warm air, direct-fired heater resulted in improved heating. Temperatures throughout the room were uniform. Since the unit was automatic in operation, janitor service was not needed.

In some parts of the country, it is common practice to relocate the school each year to insure an equitable distribution of the distance each student must travel. While one year the school may be just down the road from a student's house, the next year, it may be across the county. If the schoolhouse is to be relocated year by year, a direct-fired space heater can be moved conveniently to the new location. Basic parts are installed in each of several buildings, and removal of the heaters themselves presents no problem or serious inconvenience.

Another type of school in common use today is one that contains from two to five rooms. For these structures, space heaters may be used as full-ducted or partial-ducted installations. A partial-ducted installation has many advantages, of which probably the greatest is the fact that no separate boiler or furnace room is needed. This space heater is merely installed in one of the classrooms, or even the office, and ducts are run to rooms where heat is needed.

Low Noise Level is Necessary

This type of installation had to await the development of a reasonably large capacity, direct-fired space heater which would operate at a sufficiently low noise level to permit operation of the unit within a classroom without disturbing students in the room.

These units, which utilize slow speed multivane type centrifugal fans for air circulation, operate at an extremely low noise level. By locating the unit as close to the center of the building as possible, and utilizing wall or door return grilles, it is not necessary, in many cases, to utilize return ducts. Where it is not possible to locate the unit at a central point, it becomes necessary to use return air ducts. This increases installation costs. However, in general, return ducts have not been found necessary.

The direct-fired forced warm-air unit heater as a full-ducted installation for school buildings has the advantage of being suitable for ventilation as well as for heating. A comparison of estimates submitted for heating typical small multi-room school buildings by forced warm-air, direct-fired heaters, and those submitted for the installation of circulating hot water and steam heating systems shows the warm-air system to be considerably less in cost.

Production of Titanium Increased

Many years ago when electrolytic production of aluminum was started, the metal was selling at $5 a pound. Today, titanium is selling at that price, although it is hoped that through increased production, that the cost will be reduced sharply.

Last April, du Pont placed into production a plant with a capacity of 600 tons a year, and it is expected that this plant will reach its full production some time in 1952. Two special furnaces were designed for melting the sponge metal into ingots. The design of these furnaces is available, for the company's primary interest in titanium lies in the production of the basic metal rather than in fabrication.

Ingots up to 650 pounds are now being cast. Six new furnaces are under construction or in operation in the metals industry, and the casting of ingots as large as 1,000 lb has been reported. Once titanium is in ingot form, it is easily handled. A number of companies have already had successful experiences with titanium pieces, such as a variety of sizeable semi-fabricated pieces, including sheets, strips, wire, rods, tube and forgings.

Defense requirements have brought about new uses for the metal. For example, it holds much hope by the Air Force. It is much stronger than aluminum alloys and can operate at higher temperatures. It is only about half as heavy as steel alloys, and titanium alloys rank with steel alloys in strength. It also compares with stainless steel in corrosion resistance. In contact with salt water, it is said to perform better than almost all other metals and alloys.

Even though production of this metal is slow, one must remember that it was comparatively recent that the industry emerged from the pilot plant stage.

Air Conditioning Design Data for Food Industries

NATHAN N. WOLPERT

Specific air conditions must be maintained in some food industries for quality control and satisfactory manufacturing operations. This article covers controlled air conditions in some of the many food industries.

CONTROLLED air conditions are important in the preparation and processing of many foods commonly used. For example, controlled atmosphere is important in the drying of macaroni and spaghetti. Such highly hygroscopic powders as dried lemon and soluble coffee must be carefully packaged so that moisture will not be drawn from the surrounding air. Each of the many processed meats seems to have special requirements of temperature and humidity for the promotion of quality.

A few of the food processing fields are covered in this article to provide air conditioning and refrigeration engineers with the air conditioning design conditions found best for the processes involved and the comfort of the workers engaged in delivering the completed product in such plants.

Bakery Products

Heat generated in the dough mixers used in bakeries will cause burning unless the mixer is cooled by chilled air or brine at 33-38F.

In fermentation rooms, air conditions should be held at 78-80F and 75% R. H. Temperatures below 80F will reduce yeast cell development. It is important that a relative humidity of 75% be maintained to prevent absorption or release of moisture by the dough. High relative humidity will cause slimy dough and stickiness when handled. Air of low relative humidity will cause crustiness, prevent the release of gas, and will form blow holes and lumps. Air must be so distributed to the fermentation room that drafts, cold spots and overheated areas are eliminated.

For proofing, the usual satisfactory condition is 90F and 85% R. H. Loss of product weight can be prevented by cooling for 80 to 120 minutes at a temperature of 70 to 75F and 65% R. H.

While best storage conditions for flour is 78F and 75% R. H., a humidity of 13% is best for the maturing or aging period. Malt, yeast and shortening is best stored at 40F, while the waxed paper for wrapping should be held in stock at 50-60F.

Beer and Ale

One brewer blows air through coils of cold brine and the cooled air is then delivered to the front of aging and fermenting tanks to maintain temperatures as low as 32F. An air cooling system is used in preference to a system of circulating cooled brine to eliminate the inconvenience that results from frost accumulation on pipe and blower type evaporators. In areas where the aging and fermenting tanks are located, water is used for washing floors and tanks. As a result, with a direct expansion system of air conditioning, considerable frost would accumulate. The air cooling system succeeds in bringing down relative humidity although no attempt is made to control this moisture to a definite range.

Butter Processing

Desirable air conditions for butter processing ranges from a minimum of 65F and 35% R. H. in winter to 75F and 50% R. H. in summer.

These conditions are in the range of normal comfort for people working at machines and also within the range necessary to maintain the quality, body and texture of the product. Although it is possible to exceed 50% R. H., excessive condensation will result in some of the packaging machines, and a contaminating influence may be promoted.

Chocolate

In producing fine ground chocolate, a supply of cooling water is important to counteract the heat produced by friction during grinding. For a 50 hp motor, about 20 gpm cooling water at 35F is required in an 80F room. Where the room temperature is above 80F, add about 5 gpm to this amount. Water should not be colder than 55F nor warmer than 75F to keep the rolls at the proper temperature. Should the rolls be too cold, they will shrink in size so that some of the chocolate will pass through the rolls without refining. If the rolls run too warm, the metal will expand and the rolls will become too tight, resulting in crystallization of the sugar content, followed by scorching of the chocolate.

Chocolate Candy

For cooling chocolates, there should be little temperature differential between the temperature of the candy and the air in the cooling tunnel. If the temperature is held below 40F, the chocolate may become discolored due to moisture condensing from the warmer air. Air flow should be calculated to prevent more than a 10F rise between the entering air and the outlet air. Best results are produced where the direction of air flow is opposite the candy travel; when the

TABLE 1—AIR CONDITIONS MAINTAINED DURING THE DRYING OF MACARONI AND SPAGHETTI.

Stage of Drying	Product					
	Long Goods, as Long Macaroni and Spaghetti—Batch Dryers		Short Goods, as Elbow Macaroni — Continuous Drying		Noodles—Continuous Drying	
	Dry Bulb, F	Wet Bulb, F	Dry Bulb, F	Wet Bulb, F	Dry Bulb, F	Wet Bulb, F
Preliminary	90	80	100	85	90	82
Mid-period	90	84	95	87	100	88
End	85	73	90	78	100	88

warmer air strikes the warmest candy as it enters the cooler, the finish of the chocolate is improved.

Crackers and Biscuits

One manufacturer of crackers and biscuits has found it helpful to keep the packaging department temperature at 70-72F, with the relative humidity from 50-53%. Not only do these air conditions maintain the products in a fresh and palatable condition, but they produce comfort for the workers.

Hygroscopic Material

Substances as hygroscopic as dried molasses, or dried orange and lemon powders must be handled and packaged in atmospheres not exceeding 20% R. H. Soluble coffee should be packed and handled in atmospheres containing not over 30% R. H.

Macaroni and Spaghetti

The control of air conditions in the macaroni industry is a very important phase of production. Drying of both long macaroni and spaghetti is carried on normally in enclosed rooms and requires from 30 to 96 hours per batch, depending on the degree of control exercised. For the shorter drying rates, a very close control is required and the control temperatures are held constant throughout the drying process. For example, see Table 1, which gives both dry bulb and wet bulb temperatures for three products.

Macaroni, spaghetti and noodles are hygroscopic materials and will pick up or lose moisture, depending on the moisture content of the surrounding air. For quality control, a moisture content of about 11% is desirable, corresponding to an equilibrium condition of 50% R.H. Therefore, in the packaging room, and in the storage rooms, a relative humidity of 50% should be maintained. Unfortunately, not too many macaroni plants make any attempt to control humidity in the packaging rooms.

Another reason why humidity should be maintained in packaging rooms is that the cellophane and cardboard cartons are easier to handle and stand up better.

In the manufacturing area where the semolina flour and water are mixed, and the macaroni is extruded, it is important to keep this room warm and relatively humid—somewhere between 45 and 55% R.H.

(Continued on page 125)

TABLE 2—AIR CONDITIONS FOR MEAT PROCESSING.

Process Room or Area	Temperature, F	Retative Humidity, %
Drying room for dry sausage	53-54	72-73
Bacon slicing and packaging	55	60*
Beef holding cooler	33-34	85
Fresh pork cooler	34-38	85
Sausage wrapping	55	60*
Hog chilling—final temperature	28	85

*Steps are being taken to reduce this to 40% R. H.

TABLE 3—AIR CONDITIONS IN MEAT PACKING PLANTS*.

Room or Process	Temperature, F	Relative Humidity, %
Beef		
Chill	30-32	85-90
Curing	36-38	85-90
Car Shipping	33-35	84-87
Aging	33-35	85-87
Boning	40-45	80-85
Cutting	33-36	80-85
Bacon		
Chilling	10-28	80-85
Molding	32-34	80-85
Slicing	50-55	50-55
Calf cooler	34-36	85-90
Cooked ham cooler	35-40	80-85
Canned ham cooler	32-38	75-80
Canning meats chill	20-38	75-80
Dried beef cooler	36-38	60-65
Dry salt curing cellar	36-38	85-90
Hogs		
Chill	28-32	85-90
Cutting	50-60	60-70
Cuts grading	45-50	60-75
Lard		
Shipping of shortening	48-50	65-70
Packaging	50-55	60-65
Leak-lard cooler	28-30	80-85
Loading dock—shipping	40-45	65-70
Offal cooler	33-35	85-90
Oleo shipping	48-50	65-70
Pigs feet, curing	40-45	85-90
Pork cuts fresh	26-30	80-85
Sausage, dry		
Meat curing	38-40	80-85
Stuffing	55-60	65-70
Grinding	40-45	80-85
Sausage, fresh		
Manufacture	55-60	65-70
Packaging cooler	40-45	80-85
Sausage		
Grinding	40-45	80-85
Stuffing	55-60	65-70
Pre-chill	38-40	80-85
Packaging	40-45	80-85
Sheep-lamb chill	34-36	85-90
Smoked meats wrapping and shipping	60-65	60-70
Veal chilling	34-36	85-90

*From the 1950-51 Meat Packers Guide.

THE HIGH TEMPERATURE WATER SYSTEM

T. W. REYNOLDS

Ease of control, economy of operation, adaptability, and simplicity are characteristics claimed for heating and process systems circulating water at temperatures up to 450F

The High Temperature Water System

T. W. REYNOLDS

While the high temperature water system in its present form was used many years ago in this country, especially in connection with special process work where most accurate control was required, its wider application has been mainly throughout Europe, particularly in England. For the basis of much of the following discussion, the author is indebted to E. A. Pearce, British consulting engineer, whose extensive writings on the subject have been published in England and are credited in appended references. Simplicity, economy, and controllability are three of the many features recommending this interesting type of system to closer attention by American engineers.

A HIGH temperature water system in its simplest form, as shown in Fig. 1, is not much different in arrangement from the familiar pump-circulated, low temperature, hot water heating system. More complicated high temperature systems, however, may appear, at first glance, rather involved in operation and to need more care in design than seems economical. Actually, they appear so only because the system is not yet familiar to most of us in this country. Any complications, if such they may be called, are worth enduring for the results achieved.

The main difference between the two systems (other than that of water temperature) is the addition of a so-called mixing connection. Although this connection is the most important feature from the standpoint of control, it is merely a by-pass of the return around the boiler directly to the flow at the pump.

A second difference is the substitution of a steam boiler for a hot water boiler. This substitution is made because of the high pressure to be maintained and because the steam boiler contains steam emulsion in the waterways. Another important reason for the substitution is to provide a steam space for expansion of the hot water, not for the supply of steam to the system. The steam space is actually a substitute for the usual expansion tank.

The pressure on the system is always greater than that at which water would boil at the flow temperature. Water temperatures up to 450F are possible. At lower temperatures, say up to 250F, a steam boiler is not always necessary; for example, not where there is a separate expansion vessel into which compressed air is injected. A water boiler can be used up to 250F if it has expansion space and if care is taken to see that steam cannot form and collect in waterways, especially in cast iron boilers.

The final difference is in operation of the high temperature system at high pressures (usually 120 to 250 psig) to obtain temperatures so high (350F to 405F, respectively) that temperature drops between flow and return may range from a few degrees up to 100 or even 150 degrees. This wide range permits precise control and regulaton according to plant demand; and, incidentally, enables a small pipe to deliver a great deal of heat.

All or any proportion of the return water may be diverted at the will of the operator, either to the boiler or around the boiler through the mixing connection to the pump for recirculation back to the system, in the same way air is recirculated in an air conditioning system. The great temperature drops allowable between flow and return permit mixing of the high temperature flow water from the boiler with the relatively much lower temperature of the return. Thus, any temperature desired to suit changing conditions may be obtained for the system as a whole with a single mixing connection, as in Fig. 1; or any number of different temperatures may be obtained at the same time, as in Fig. 2, to serve requirements for space heating and the several processes demanding different temperatures. This can be done simply by relocating the mixing connection from the boiler at the main return (Fig. 1) to the common return pipe header (Fig. 2) and then mixing by way of flow valves 2 and mixing valves 3.

Small Bore Systems Formerly Used

As a rule, high temperature water is referred to as high pressure hot water, but a better nomenclature is high temperature water, since water can be increased in pressure without an increase in temperature.

Systems no longer used, formerly known as high pressure hot water systems, were in vogue many years ago, particularly for special process work. These had their limitations. The Perkins system (Fig. 3), for example, which originated in Britain in 1845 and contained water at temperatures of from 300F to 600F, comprised an endless circuit of pipe (13/16-inch bore and ¼ inch thick) with part of the circuit (about 10

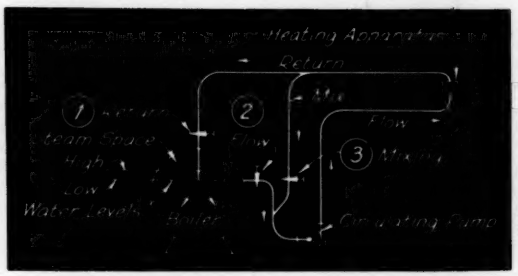


Fig. 1. Simple high temperature water system.

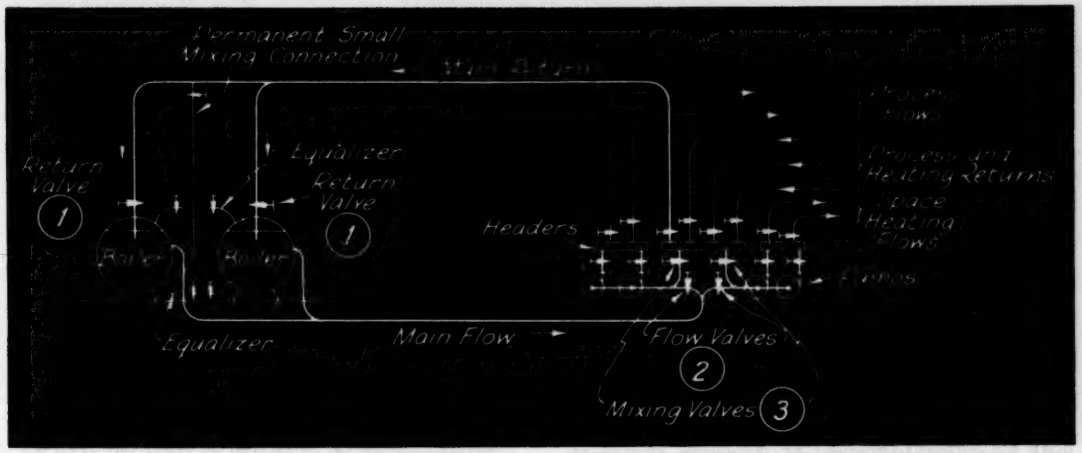


Fig. 2. Flexibility of the system.

to 15%) within a brick furnace. Since the pipe was of small size, it lost heat so rapidly that a 500-ft circuit became the limit; hence a number of 500-ft circuits had to be used (two such circuits, with coils within the furnace, being shown in Fig. 3). So the Perkins system had its day and went its way.

General Advantages

Since about 1909, there has been many a high temperature water system constructed and still working with nothing but the simplified central equipment shown in Fig. 1. Further additions to suit circumstances have been made, but before taking up the detailed workings of both the simple and more complicated high temperature water systems, let's consider the advantages of the system.

First, the generalized statement may be made that a high temperature water system has most of the advantages of a properly designed and installed high pressure steam system, yet without many of the disadvantages of a steam system.

Both the flow and return of high temperature water can be run up or down and at various levels to suit physical conditions of structures and contours of the ground between structures without bothersome problems in trapping, lifting, condensate collecting, or extra pumping capacity. Both initial installation and subsequent extensions of an existing system are thus greatly simplified.

No steam traps or pressure reducing valves are required. Nor is any remote, heavy-duty condensate pump required to force condensate back to the boiler against such large pressure differences as exist in steam systems. In the case of high temperature water, distance offers no special limitations. Pressure drop, within wide limits, has no direct effect on temperature or state of high temperature water, hence noise and water hammer are not a problem in long runs.

Since the requirement of several different temperatures can be met in a high temperature water system without pressure changing devices or other complications, there is a resulting economy not only in the cost of original specialties but in the greatly reduced inspection and maintenance program.

A further economy is realized in high temperature water systems because of the slow rate of corrosion and erosion in a closed, recirculating water system. Make-up water, with its corroding oxygen, scale forming chemicals, and costly treatment, is reduced to a minimum so that boilers and piping both remain in service over long periods of time without shut-down for cleaning and repairing.

Other advantages of high temperature water are: Less erratic firing, due to heat storage in the water of the system; economy in fuel (usually 25%); reduction in cost of erection and maintenance; precise control obtained as required for processes; and the use of lighter pipe due to the absence of corrosion and erosion. Convenient utilization of waste heat and exhaust steam to produce high temperature water provides still other advantages.

For all the given reasons, a high temperature water system has great advantages even for small plants. Its advantages, however, become greatest and most attractive only when used for large industrial plants where the heat load is, say, 20,000,000 Btu per hr.

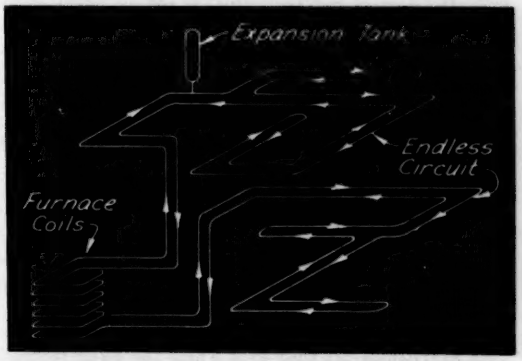


Fig. 3. Former small bore system.

Precise Control More Easily Obtained

In a high temperature water system the control of temperature is precise and centralized. Several different temperatures can be carried at the same time by a simple mixing arrangement, as previously described. Temperature, pressure, and pressure drop are each controlled without change of state of the medium and without the inaccuracies induced by condensation, throttling, water logging, or other difficulties inherent in the nature of steam. High temperature water regulates easily and accurately, because regulation depends only upon the sensible heat available in the quantity of water allowed to pass through the heater.

Comparative Heat Storage – Steam vs. Water

In a high temperature water system there is no need for either permanent or occasional change of boiler pressure to suit changing conditions. Even distribution is maintained throughout the system regardless of fluctuations in either boiler pressure or load. This is so largely because of the heat stored within the plant and system. There is then much less need to draw directly upon the boiler for heat at periods of sudden peak demand on the system. Should there be such a need in certain cases for special processes, it can easily be satisfied and smoothed out by adding a heat storage accumulator. Heat storage makes for smooth and easy working and the maximum of economy in both operation and maintenance.

A good example of comparative heat storage is to consider equal volumes in a high pressure steam system and a high temperature water system, both at 120 psi. Of course, in practice, the volumes of two comparable systems might not be exactly the same due to the difference in pipe sizes. The high temperature water system might have 5-inch or 4-inch mains, depending upon whether the temperature drop was 100 or 200 degrees, whereas a comparable high pressure steam system would have a 5-inch supply and only a 4-inch return. However, the nature of the example which follows justifies the use of equal volumes.

Proceeding, we find that each cubic foot of the saturated steam when condensing at the given pressure and subsequently cooling to, say, 190F would liberate about 300 Btu, while the same volume and pressure of high temperature water cooled to the same degree would liberate 6500 Btu per cu ft (assuming a reasonable mean water temperature of 300F). Thus, at the given commonly used pressure, each cubic foot of high temperature water holds over 21 times as much heat as an equal volume of steam. In reality, the water system contains a much larger proportion of available heat because the comparison was made with a steam system which, of course, has no steam either in the return or the water space of the boiler. In a water system, both of these spaces contain the vast amount of heat available in high temperature water.

Ease of Control Over a Wide Range

An example of the ease with which the temperature of the water can be varied over a wide range to suit requirements without change of boiler pressure is in the operation of a certain plant where the system rambles over a site of 22 acres. This system is designed to operate at 120 psi and the minimum allowable steam pressure for the processes is just half of this design pressure. The maximum heating load is 30,000,000 Btu per hour and the process load is about 2,500 lb of steam per hour.

With all in operation at the pressure required, the temperature of the water leaving this central plant has been changed from 316F to 230F, then back to 325F, all in 30 minutes. These figures are not usual requirements, but are given to illustrate extreme possibilities and the ease with which water can be delivered at a relatively low temperature, once the workshops have become warm. Adjustments, of course, can be manual or automatic with the rate of adjustment prolonged as desired.

Before passing on, it is well to point out that the temperature of flow water has downward limitations advisable in some cases. For example, the temperature of water at unit heaters must be sufficiently high to prevent discharge of air at uncomfortably low temperatures, even while the space may be reasonably warm as shown by a thermometer.

Steam heating by injection in dye vats is a good example of bad control. Such vats are usually required to be held at 212F, and, with steam, it is not possible to prevent the vats from giving off a continuous waste of vapor and a nuisance of fog, while making certain that the correct temperature is reached. With high temperature water, it is possible to maintain exactly just below vaporizing temperature which is still sufficient for process.

Water Make-Up and Treatment

In a high pressure steam plant, any of the steam which flashes and goes to the atmosphere or is not returned for various reasons, any leakage, and any evaporation and overflow at the hot well (particularly when starting up or when the plant is not properly handled) are all a definite loss of heat and water which must be made up by heating and supplying an equal amount of cold entering water. In a high temperature water system the return water contains all of the unused heat, and the difference in the heat carried by the flow and return is almost entirely expended in useful work, whereas the actual loss of heat in a high pressure steam system is often 25% or more, although theoretically it may be computed as only 15%. The boiler feed pump in a high temperature water system is usually electrically driven so that the use of steam and corresponding make-up is here again avoided. Sometimes a stand-by steam pump is installed, but this is only a stand-by.

Loss of heat is one thing; loss of water another; for water loss produces evils in addition to the cost of make-up itself. Leakage in a high temperature water system is not substantial. For example, a 90,000 gallon installation required but one quarter of one per cent of the make-up required for an equivalent steam plant, and this figure even included the annual refill. Compare this with any good high pressure steam system

where the make-up water is often 5% of the rated boiler evaporation.

When all is considered, water treatment is found to be unnecessary even on very large high temperature water plants, unless, of course, steam is withdrawn from such a water plant. Due to the extremely small amount of make-up water normally used, the necessity for blowing down of the boiler is quite infrequent. This, again, reduces the amount of make-up required. On the other hand, water treatment to make up for occasional or continuous blowdown is a necessary part of a high pressure steam plant. Water treatment preserves the steam boiler, keeps valve spindles moving freely without incrustations and leakage and definitely requires a substantial make-up.

Reduction of Plant Size

All of these savings (lessened make-up, infrequent blowdown, better control, and the other things itemized, together with increased efficiency of internal boiler surfaces kept free from scale) save fuel and greatly reduce the size of boiler plant otherwise required. Still another factor not included in the foregoing is the improvement of heat transfer within the boiler due to the large amount of water passed through the boiler at a relatively low average temperature. Furthermore, it is estimated that a high pressure steam boiler plant must be 25% larger, just for rapid recuperation while heating up and taking care of fluctuating loads. All this can be met by a much smaller boiler plant in a high temperature water system simply by the heat accumulated in the system.

The small amount of make-up required in high temperature water systems may eliminate any need for a boiler feed pump in small plants, but in any event the pump is small compared to that in a high pressure steam system where all of the condensate is returned through this pump. In a high temperature water system, whether boiler feed is by pump or simple steam injector, all that is necessary is that the small amount of make-up enter through the feed check valve of the boiler, the same as in any steam raising boiler.

Everything else is also simple, since there are few working parts. Boiler trim need only be in accord with accepted steam boiler practice, except for the gage glass which often has to be longer than usual to show expansion of water content.

Operation and Working Pressure

Whenever it is desired that the flow water go to the system at its maximum temperature (350F at 120 psi), return and flow valves 1 and 2 (Fig. 1) are opened wide and mixing valve 3 closed. Then, as the system requires cooler water, mixing valve 3 is gradually opened. Should this valve when fully opened fail to give cool enough water, then flow valve 2 should be gradually closed, even fully closed for short periods if found necessary. Note that closing valve 2 will completely remove the load from the boiler, so that firing rate must be controlled accordingly either automatically or otherwise. Rapid manipulation of the valves alters the boiler load, so care must be taken that valve settings are not changed more rapidly than the boiler and fire control can respond.

On large installations, it may be more economical, both in first cost and in operation, to operate at a pressure of 250 psi, thus making it possible to use a large temperature drop with consequently smaller mains. High pressures are also necessary in some cases because of a particular process requiring either steam or hot water. On the other hand, any pressure above the usual 120 psi requires very expensive valves and fittings. Boilers also become more expensive and certain makes of unit heaters cannot then be obtained in the standard type.

If a system has been designed to operate at, say, 350F, transformation to lower temperatures of steam or water may still be made at any point of the distribution system (as may be locally required), simply by the use of heat exchangers or other means. For example, a group of industrial buildings may have water at 350F for the work areas while the offices use water at 180F because of the use of cast iron radiators, or only 120F because of embedded panels. The kitchen may even be provided with low pressure steam for cooking purposes merely by the installation of a local heat exchanger.

Temperature Drop

Since the high temperature water system possesses the advantage of flexibility in working pressures, temperatures and temperature drops to suit conditions or installations, it is not advisable to eliminate this advantage by standardizing pressure or temperature conditions. Temperature requirements, hence pressures, may be the deciding factor. Temperatures may have to be suitable for the platen of a press, local steam transformer, or special drying oven, or again the main requirement may be pressures suitable for steam service from the same boiler to a steam engine. With each installation, the engineer must just do a lot of thinking and as much computation to find the right answer for the particular installation.

Temperature drop affects the cost of insulation, piping, valves and their erection to a much greater extent as the installation becomes large. For a delivery of only 500,000 Btu per hr, a 2-inch pipe is required for a 50-degree drop and a 1½-inch pipe for a 150-degree drop, assuming the same friction loss in each. On the other hand, multiply this load by 100, and the correspondingly required pipe bore will be reduced from 10½ inches to 7 inches for the same increase in temperature drop.

Savings go farther than first cost alone, for smaller pipes emit less heat and there is less water to circulate as the temperature drop increases. However, these factors are of no moment for smaller systems, as exemplified in the foregoing paragraph. Hence, for such systems, a drop of 50 degrees will be sufficient and this will allow a correspondingly lower boiler pressure to be used.

More expensive valves and fittings are required where the boiler pressure exceeds 120 or, say, 150 psi. Higher pressures and temperature drops also require more expensive boilers, trim and auxiliaries, and heat-

Fig. 4. The high temperature water system serving many things.

ers may have to be specially designed. Still the additional cost of all these items because of high pressure is very much less than the savings by high temperature drop, providing the installation is a large one. As a consequence, for the larger installations, drops of 100 to 150 degrees are often used. For large installations, even where some special apparatus requires a small temperature drop, the balance of the system can still be operated with a much larger temperature drop.

With a boiler pressure of 120 psi it is quite common to use an over-all drop of about 80 degrees and a drop across the heaters of 60 degrees. One system erected in 1913 had a flow temperature of 275F and a return temperature of 160F; quite a drop for such a comparatively low initial temperature. The result was a great saving in piping and other items mentioned, especially so because the building served was half a mile distant from the power station.

Needless to say, combining heating and power generation offers possibilities in the heating of water by the exhaust from generator turbines. In such installations, heat accumulators can tide over peak demands. Ingenuity can be applied in many ways to design in such cases. To accommodate demand for electrical output, there may be two sets of distribution flow mains, one at high temperature for process work, the other at a much lower temperature for space heating. There may be two separate returns, or just one common return. Different temperatures for different equipment can then be supplied by heat exchange or by mixture from the two flow mains.

Fig. 2 illustrates a typical and actual high temperature water system. This system is just as simple as the one shown in Fig. 1. The real difference is that there is more of it. Since there are two boilers they are equalized by the cross connection shown. This connection should maintain static conditions, hence it must be of ample size and have no steam supply branches taken from it.

The two pumps on the right (Fig. 2) are used for space heating. One of these pumps is a stand-by. Either pump takes water from the common flow main through valve 2, or the common heating and process return header through mixing valve 3, or from both in any proportion desired. The remaining pair of pumps operate in a similar manner, but for process. Several circuits are shown for the returns. Multiple circuits permit convenient control by valves at the central plant and help keep down pipe sizes; but a common return main can be used if desired.

A few of the many uses to which high temperature water can be put to advantage are also shown in Fig. 4. The flow from the boiler is split to supply two groups of hot water equipment, each group with its own pump. One pump takes care of process equipment at constant high temperature, while the other is used for space heating with the temperature of water varied in conformance with the weather. The only thing common to both distribution systems is the single return main.

High temperature water and the flue gases are not far apart in temperature, hence the use of an economizer is seldom justified; but with a heat accumulator in the return piping at the boiler, the return water temperature is so reduced that an economizer (Fig. 4) can be used. Reduction of return water temperature by the accumulator also allows the maximum temperature range of adjustment at the mixing connection. Load fluctuations are also smoothed out by the storage of heat in the accumulator. For example, some power plants store 400,000,000 Btu in heat accumulators, thus avoiding the necessity for added heat generation during peaks.

Heat transformers or exchangers are shown in Fig. 4, but are not necessary if the equipment can take high pressure, because heat control can be obtained through a mixing connection.

The Mixing Connection

At times, and depending upon the particular installation, it may be desirable to pass all of the water through the mixing connection. Such may be the case, for example, when starting up and again when cooling down, particularly so if it is desired to use much of the heat accumulated in the system before the plant is shut down. To obtain these benefits in full, the mixing connection must be able to handle all of the water with a frictional resistance but slightly more than the resistance of the alternate route through the boiler. Resistance of valves and fittings should also be computed for both routes.

This calls for careful sizing of the mixing connection, particularly where the conditions are as shown

in Fig. 2. Here the mixing connections are rather close to the pump suctions and are rather short, whereas the circuit from collecting headers and back again to the suction headers is rather long. If, then, the mixing connections are sized too large, water is apt to short circuit through the line of least resistance, bypassing the boiler flow water much more than desired even though the mixing valves are nearly closed. Very little regulation would then be left for temperature adjustment. However, with correct sizing, only a half turn of the wheel on mixing valve 3 or flow valve 2 (according to which is in use at the time) will be noticeable as temperature change on the thermometer.

Thermometers should be fitted to the flow from the boiler, the common return header and the distribution header. These should be positioned for convenient observation when mixing adjustments are being made and should be of a type quickly read. In Fig. 2 there should also be a thermometer fitted to each return before it enters the common collecting header, thus enabling adjustments to be quickly made to suit load variations on each circuit.

A common way of injecting the return water into the flow water is to place a nozzle concentrically inside an enlargement of the flow main at the end of the mixing connection. Some use a removable pipe inserted into the back of a bend in the flow main, the pipe having a blind end, but with longitudinal slots through which the cooler water flows. The withdrawal of this pipe allows the size of slots to be altered permanently for final adjustment. Such a pipe can also be provided with an outer sleeve similarly slotted so that final adjustment can be made by mere turning of the inner pipe.

Still another method (one sometimes used on large installations to eliminate possible knocking and surging as two bodies of water of far different temperatures meet) is to terminate the mixing connection inside the boiler just below its low water level where it discharges into a specially arranged flow connection. This does away with any hammering, even in the suction connection between the boiler and pump, because the water is reduced to the required temperature before it leaves the boiler. Such a connection may be particularly helpful if the pump and boiler are far apart.

When the internal connection is used, it avoids the need of the additional or small permanent mixing connection such as shown in Fig. 2 and described in the adjacent column. However, the internal mixing connection cannot be used in the particular installation shown (Fig. 2) because there is only one common flow to two return circuits which operate at different temperatures.

Where there is no hammering or pounding that is annoying or detrimental, the mixing connection need not be made as complicated as just related. Rather, it should be as simple as the plain lateral connection shown in Fig. 1. Usually the mixing connection is made so close to the pump that mixing is thoroughly completed within the pump itself. A regulating valve in the suction flow just before the entry of the mixing connection is of considerable help in temperature regulation on light load, particularly so in large installations. Even finer regulation can be obtained by a smaller valved by-pass around the larger valve.

The circulating pump must be specially constructed for high temperature water at high pressure. Bearings, and sometimes the glands, are cooled by running cold water. Otherwise the pump is the usual pump with casing of a semi-steel, so-called, but in reality a high grade close grained, cast iron. A good class of such iron is suitable for working pressures up to 125 psi. Cast steel should be used for higher pressures, and even for slightly lower pressures, if found advisable by the manufacturer of the particular pump to be used.

The circulating pump should be located in the flow main to prevent flash steam from any water at lower pressure than that of the pressure within the boiler. Pressure throughout the entire system must always be kept above that at which the water will boil, otherwise the water cannot be circulated because of the steam. Locating the pump near the boiler, but on the return instead of the flow, exemplifies the point, since in such a case the pressure in the piping system all the way from the boiler and back again to the pump will be lower than in the boiler.

For the same reasons the suction pipe from boiler to pump should be kept short and direct as possible to avoid undue resistance and flashing at the pump. It should grade down to the pump and, when run above the boiler water line, should be fitted with a venting cock for steam removal during the time the pump is not running.

Where there are several boilers and a separate pump room some distance apart, use should be made of a small additional mixing connection at the boiler (Fig. 2). This connection is fitted with a lock shield regulating valve for a permanent setting that will prevent flashing in the suction pipe by maintaining therein a temperature slightly lower than that of the water in the boiler.

For example, with the water in the boiler at 120 psi and 350F, an assumed rise of the pipe is 12 ft above the boiler, a resistance of suction pipe and fittings of, say, 48 inches w.g.; then due to this friction loss and the lower static pressure, the pressure at the pump suction connection will be reduced to 113 psi. The corresponding temperature at this point is then 345F, hence the permanent mixing connection must be large enough to pass sufficient return water to cool the 350F flow water down to 345F in the flow main.

Some engineers like to use a balancing connection at the circulating pump. This is a small by-pass around

Fig. 5. (Left) How NOT to vent the main. Small connections should be avoided. Fig. 6. (Right) Improved venting and a means of stepping up the main.

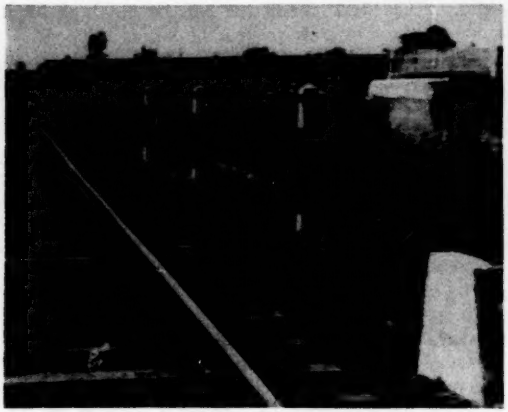


Fig. 7. Pipes near ground easily maintained.

the pump from suction to discharge containing an isolating valve and a non-return valve. The by-pass allows static boiler pressure at the pump suction to be by-passed to the discharge side of the pump. This is desirable when the pump is stopped and the isolating valves closed. The pump can then cool down with boiler pressure still maintained on the system while the boiler is banked for the night.

Initial Fill and Warming Up

The system is filled by a length of armored hose connected from a fixed cold water supply to high pressure cocks with hose unions on the bottom of the main hot water distribution and collecting headers. Meanwhile, the vents are opened on the distribution system. There must be no permanently fixed connections for either water supply or drainage.

Before the system is started after initial fill, the engineer must make certain that the entire system (including any heaters) is properly filled and all air removed, the boiler being filled to the cold or low water level. These precautions must also be taken each time the system is started after cooling down. Cooling water must also be flowing freely to the bearings of the pump and to the induced draft fan, if any.

The procedure in starting is to close tight return and flow valves 1 and 2 (Fig. 1) and then open wide mixing valve 3, after which the boiler pressure is raised to about 60 psi. This is done to prevent the falling down of cold water from piping at higher levels due to loss of pressure or contraction. The return valve 1 is then slowly but slightly opened to exert static pressure from the boiler on the system. Next, the pump is started to put the cold water of the system into circulation from pump and back again, but only by way of the mixing connection, because flow valve 2 is still closed. This valve is now opened just enough to mix a small amount of water at high temperature with the cold water flowing through the mixing connection. In this manner the entire system is gradually warmed, and when hot enough, flow valve 2 is opened wider by stages, until the temperature of the mix has reached the desired point. The procedure is rather involved as put in writing, but in practice it isn't. Care and not skill is required.

In some installations it has been found better to put the system under pressure by opening the flow valve instead of the return valve as described. If piping is not too high, one can open all three valves before starting up or starting the pump, so that the system is gradually warmed and pressurized while the boiler is being heated and its pressure raised. This method, however, gives less control over operation and takes longer. If piping is at a high level, such as in the roof of a factory, this method cannot be applied successfully.

Some engineers use a cross connection between one of the flow headers and the return collection header (Fig. 2) to circulate hot boiler water through the pump, headers, and piping of the central station, warming these up before hot water is turned on to the flow system beyond the headers. This method can heat the piping so fast as to damage valves, pipes, and joints, so it must be done slowly.

Venting

Short lengths of tubing welded into the pipes where venting is required form sludge pockets and trap air for ultimate release. Small connections to the main,

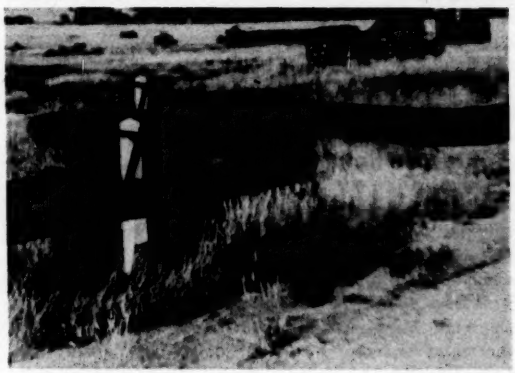


Fig. 8. Point suspension reduces heat losses.

such as that shown in Fig. 5, should *not* be used because most of the entrained air will pass by a small connection. Air bottles of large tubing can be used to provide a convenient point for a step-up of the main (Fig. 6), as well as an improved air pocket. If this cannot be done, a full bore bottle should be welded to the top of the main, without a small connection or narrow neck. These tubular pockets should be able to store enough air, hence they should be of larger size than the pipe vented, or at least of the same size.

Piping should be graded up in the direction of flow with the air bottle at the far end of a run. If graded otherwise, air will be carried along with the flow and collect at the low points. A small ¼-inch needle seated globe valve with pressure under the valve seat gives manual air release. Small plug cocks are used at drain points, and sometimes a specially designed plug valve is used for both venting and draining.

Expansion of Water Content

Although special cylinders are sometimes provided to take up the expansion of water by the compression of steam, or by air kept automatically at the required pressure, expansion into the steam space of the boiler is the more usual method, even on installations up to about 40,000,000 Btu per hr. This method retains most of the original water and so keeps down make-up and boiler scaling.

The boiler should be selected on the basis of taking all of the expanded water. This may not be possible on an installation of, say, 150,000,000 Btu per hr, hence in such an installation, further expansion has to be provided by open blowdown cock until the excess of expanded water has been eliminated from the system. One must not forget that a system operating at 120 psi may increase its temperature from 45F to 340F, resulting in a 12% increase in volume, so that observation of high water level at the boiler may call for a longer than usual gage glass.

Pump Duty and Pipe Sizing

Temperature drop across the boiler does not necessarily determine the capacity of circulating pump required. Instead, the determining factor may be the drop across the flow and return headers to which the pump is connected. On large installations, pump size can be kept down to practical limits by the installation of three or more pumps connected in parallel to common headers. Should one pump fail, the service is then not seriously impaired. If an additional pump is installed, any one of the group can have its rest periods.

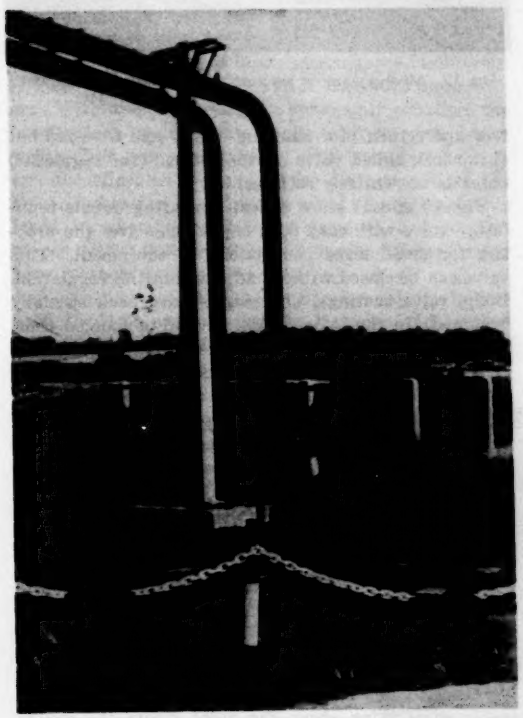


Fig. 9. Short posts are more economical.

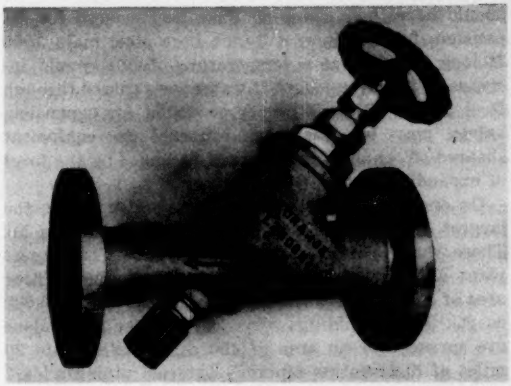


Fig. 10. Double regulating valve.

Pump duty and pipe sizing must take into account the considerable decrease in the density of water as its temperature becomes high, otherwise the additional resistance of a circuit may be underestimated. For a load of 20,000,000 Btu per hr, temperature drop of 80 degrees and a mean temperature of 310F, the commonly used density for water would indicate 25,000 gallons per hour, but a density figure corrected for the given temperature conditions would give an additional gallonage of 1,550 to be circulated. Then, again, it must be considered that at times the pump may handle water at a boiler temperature of 350F instead of at the mean temperature. In the given example this would call for a still further addition of 650 gallons per hour.

In order to closely balance pipe circuits and possibly effect economies, it may be advisable with installations of very large size and temperature drop to compute separately the volumes of flow and return to the end that return sizes can be reduced. Of course, in such an event, the temperature would not be the mean, as used in the foregoing example.

Piping

In addition to savings effected in pipe sizes by the use of large temperature drops, there is a saving due to the lighter weight of pipe used with high temperature water. For such service, commercial solid drawn tube is used with much thinner wall than that of ordinary lap-welded steam quality pipe. For example, one foot of the last named weighs 9.8 lb compared to 6.3 lb for the tubing used.

Piping joints are usually welded except for flanges at valves and equipment, and even these could have welding ends where obtainable. Branches take off at easy sweep; all full radius bends are used wherever a change of direction is required.

Provisions for expansion are as important as they are for high pressure steam at the same temperature. High temperature water mains are apt to bow before ordinary steam expansion loops close. Pipe hangers

should have their swinging links long enough for expansion, for example; a 3-inch bore steel main 1000 ft long installed at a temperature of 50F would increase 28 inches in length if water were passed through it at 388F. Without proper provision for expansion, valves may be fractured, branches to equipment sheared off, and equipment itself damaged by the force of expanding metal.

On one large site there are three boiler plants, the largest of which has a load of 85,000,000 Btu per hr. These three plants serve 6 sub-depots. The largest plant alone serves 24 large buildings having a floor area of 1,500,000 sq ft and a cubic content of 37,000,000 cu ft. These buildings served by the one plant alone are spread over an area of 400 acres and contain 26 miles of distribution piping. External piping adds 7 more miles, of which the longest circuit is 3½ miles. Mains in one direction are 10-inch bore, 7-inch bore in the other direction, but stepped down as branches are taken off. Temperature drop in the 10-inch flow main as read 1½ miles out was only 9 degrees, and this with water initially at 350F.

Down along the tracks these pipes go (Fig. 7) with expansion bends at intervals (Fig. 8) and over a railway and road (Fig. 9). As shown, supports swing free for expansion and have point suspension to keep down heat losses from conduction. Short posts are arranged for the correct span of each pipe size. Posts in the photo are about 30 ft apart. Where possible, all mains are kept near the ground for the sake of appearance, ease in erection and maintenance, and economy in posts.

High temperature water piping should be well insulated for better control and to reduce heat emission losses. Compared to low temperature water and high pressure steam systems, which lose heat mainly on the supply (assuming all systems to be without insulation), an equivalent high temperature water system could have a heat emission loss from piping about triple that of a low temperature water system and about 65% greater than a high pressure steam system. Insulation on the pipes of all systems would, however, give less difference in heat losses between them.

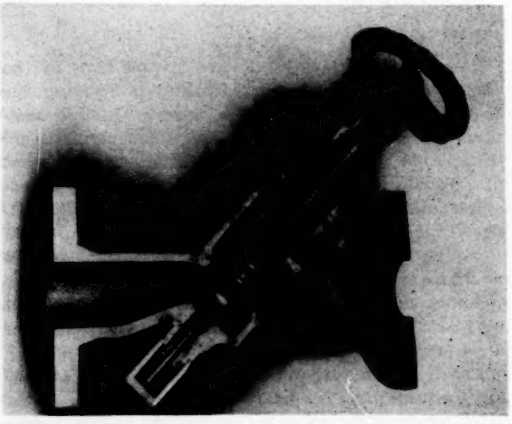


Fig. 11. Looking inside the regulating valve.

Valves

For high temperature water, parallel slide valves are often used similar to those for steam, but with special gland packings and glands. High temperature water does seem to be more penetrating than one would expect, and, unfortunately, any small amount of leakage immediately disappears. Slight leakage only becomes noticeable on the outside of the gland and spindle of a valve by a deposit from the salts in solution left behind during evaporation. If this deposit is not cleaned off, a stalactite forms which may bind the spindle of a valve either manually or automatically operated. Leakage seems to be caused in part by capillary action.

Regulation at the various heaters and convectors must be good even when piping is carefully sized because a small amount of water contains a lot of heat when temperature drops are high. Usual means of regulation consist of one wheel valve on the flow connection and a lock shield valve on the return. Such regulation takes time to effect and is lost when the valves are closed for maintenance purposes. Even a more expensive arrangement of a wheel valve on both

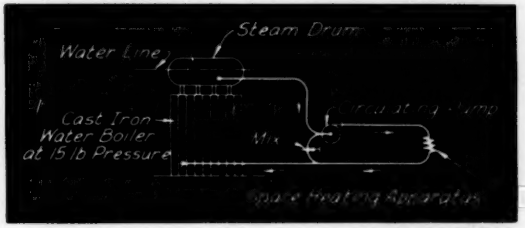


Fig. 12. Mixing water in medium temperature closed system.

flow and return (for shutting down) and a second but cheap lock shield valve on the return (for regulation only) is not entirely satisfactory.

Fig. 10 and 11 show a neat appearing double regulating valve with easy flow, one which solves the problem for small sized connections to equipment. This valve can be closed without affecting initial regulation. Body, valve seatings, and glands have been specially designed. In the ½-inch size, instead of flanged ends, special unions are fitted with steel tubular ends bevelled for welding to the pipe connections. This size is sufficient for most connections to convectors, coils, unit heaters, and tubes. Regulation is effected by means of an auxiliary seating and is independent of the main valve seating. No matter how closely it is set, the main seating cannot be affected by any wire drawing. Nor can travel of the main valve be altered by regulation. Such a valve cannot be interfered with by unauthorized persons.

Boiler Connections

In the event of a break in piping, it is possible for some water to leave the boiler by way of the return and thereby leave dry such heating surface of the boiler as remains above the point where the return pipe terminates within the boiler. Hence, a non-return

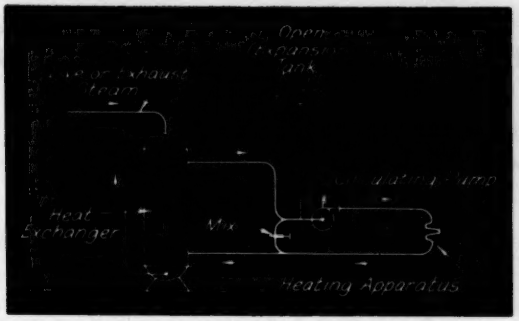


Fig. 13. Mixing water in medium temperature open system.

valve should be installed on the return for such a condition, but none is required if connection for flow and return end just below low water level so that the continuity of reverse flow is broken at that level and the heating surfaces remain covered.

A point has also been raised at times that the pump might take water from the boiler by the return and mixing connection, but whatever is pumped out must be returned. If the suction were balanced on the flow and return connections no water would be drawn from the boiler. When, however, this balance is upset, so that water is drawn, it must leave by the flow connection. Such displacement cannot help but be replaced by water entering through the return connection.

Some engineers make use of a small injection line from the discharge side of the circulating pump to boiler steam space wherein it is terminated with a sparge pipe in each boiler. The effect of this mixed flow water thus sprayed in the steam space is different if there is only one boiler than if there are more boilers. With only one boiler the spray only equalizes the temperature of its steam space with its own boiler water, thus reducing surging. For two or more boilers, the effect is to equalize the temperature of the steam spaces and the water in all of the boilers. This tends to smooth out variable pressure and temperatures within the several boilers due to different firing rates of these boilers.

Whether or not an injection line is used, the boilers should still be properly fitted with steam and equalizing pipes. An injection line should not be used where steam delivered from the same boiler must be dry.

Various Applications

A great many applications of high temperature water systems have been made, and possibilities exist for many more. For example, a closed hot water system with cast iron sectional boiler could be operated with a mixing connection (Fig. 12) at pressures up to 15 psig. Any steam formed would be vented from each section by a large steam expansion drum above. This system can be of the open type if the expansion tank can be elevated high enough to prevent evaporation at full boiler pressure. Where a certain temperature may be exceeded, the expansion tank can be elevated and designed to give immediate relief as the maximum pressure is exceeded (Fig. 13). The primary circuit to the calorifier (heat exchanger) here shown could be live or exhaust steam, high temperature water, or even a cast iron boiler, as in Fig. 12.

Fig. 14 illustrates how high temperature water can be warmed by a calorifier utilizing exhaust steam and an automatic live steam make-up, the live steam being also fed to a closed expansion tank. Fig. 15 shows an arrangement for taking steam bled from a turbo-generator and live steam make-up to a cascade heater, a more efficient heater than a calorifier and in this case also designed as an expansion vessel. Surplus water from the condensing steam is automatically returned to the boiler with the main condensate returns by the boiler feed pump.

No one plant contains all of the equipment shown in Fig. 4, but it is offered as food for thought on some applications that have been successfully used in the aggregate of various high temperature water plants. Fig. 16 shows still another application. This is typical for many a case where the retention of high pressure is not detrimental and a low temperature sub-circuit must be used as for the heating of small offices in a workshop. In such cases, heat transfer may be from a high temperature circuit by mixing water rather than by a heat exchanger. Pipe coils can stand the higher pressure and the pump must be selected to withstand the full static pressure of the main system, although it need not have water cooled bearings.

The amount of high temperature water passed is controlled by room thermostat and modulating valves. Maximum water temperature is fixed by a sensitive element in the low temperature flow main. This limit stat prevents a continuation of temperature rise when the system is first started due to the room stat calling for more heat before the pipe coils have time to warm the room. A similar arrangement is often adapted for any process equipment requiring constant temperature and temperature drop conditions. In such a case the room stat is not used.

Sometimes a kitchen may be so distant from the main boiler plant that special steam piping from there would not be practical or economical; furthermore, any cooking apparatus using high temperature water be-

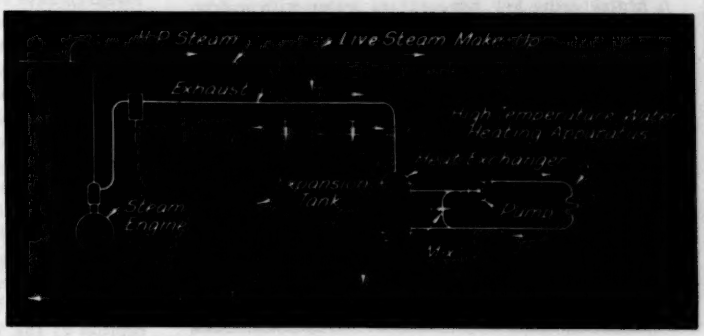


Fig. 14. Utilizing exhaust steam by heat exchanger.

comes expensive and more complicated because of the high pressures it must withstand. In such cases, it is better to use a local steam generator designed somewhat as a water-to-water heat exchanger, but classed by official and insurance interests as a steam raising boiler. Advantages of the arrangement (aside from elimination of the long steam main from the boiler plant) are that the local plant is composite with the kitchen equipment, while the main boiler plant still retains all the advantages of remaining connected to a closed system.

The thermal storage or fireless locomotive is an interesting application of high temperature water and one that demonstrates the great heat storage capacity of such water. It is a safe locomotive around powder plants, chemical works, mines, lumber camps, plantations and factories; or warehouses where materials such as oils, paints, celluloid, cotton, wool or paper are stored or manufactured. It needs, of course, an occasional contact with some stationary boiler plant having available steam or high temperature water. It would, therefore, be useful for shunting and hauling at electric generating stations.

The locomotive contains a thermal storage cylinder about three-quarters full of cold water which can be heated by steam injection near the boiler plant, but outside the danger zone. As steam from the reservoir is used by the locomotive, more steam is formed by the reduction in pressure. A reducing valve supplies constant low pressure steam the meanwhile and just enough pressure to drive the locomotive back to the boiler plant for recharging, say two or three times a day. A charge takes but 15 minutes. Effective insulation of the reservoir makes it possible to leave the engine overnight, yet start if off the next morning on its charge of the day before. An ordinary workman can drive this locomotive. No fireman is needed. Boiler pressure is automatically maintained. Cost of construction and maintenance is much cheaper than with the usual steam locomotive.

The heat emission from a heater using low temperature water is affected by the velocity of water through it. This becomes even more apparent when the water is at high temperature because the heat content of the water and the temperature drop are both so much greater. Temperature drop may vary from 40 to 120 or even 160 degrees in special cases, while the mean temperature may be up to 350F.

A heater using low temperature water with a drop of 20 degrees may have an output of 100,000 Btu per

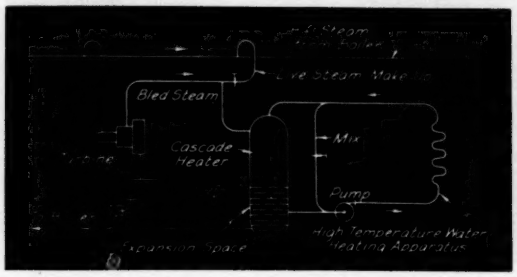


Fig. 15. Utilizing exhaust steam by spraying.

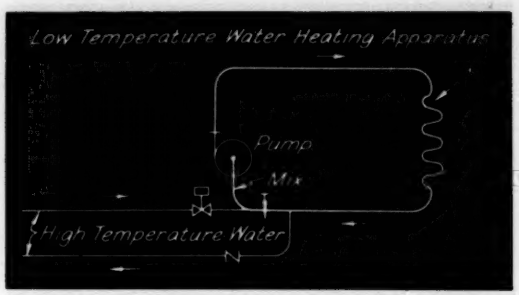


Fig. 16. Heating a low temperature circuit.

hr. With a drop of 40 degrees the velocity of water would be halved and the heat emission reduced by about 5%. The same heater with high temperature water may have its output doubled at a 20-degree drop, but if the drop is raised to 100 degrees, the water velocity lowers to one-fifth and the heat emission may fall off by 15%, even though the water be at the same mean temperature. Now 15% is only three times the 5%, but it is six times as great in heat units.

A small burr or flaw in some tubes of a heater or a difference in travel to them may prevent any high temperature water passing through such tubes. This is bad, because the total flow of water at such great temperature drops is very small and therefore easily affected by any stoppage.

Tests conducted on unit heaters of various types with high temperature water drew the conclusion that it is not necessarily correct to say that the output with hot water is less than with steam at the same temperature. Output can be equalled or even exceeded if agitators and proportioning nozzles are used, or the heater designed for higher water velocities even though the temperature drop is wide.

Output of convectors could be increased by increasing the flow of water or by arranging tubes for series flow. Incidentally, all high temperature parts of convectors are safely enclosed in the casing. As for calorifiers or heat exchangers, as they are termed in this country, they too could be improved in output by increasing the velocity of water flow. In some cases, flow proportioning nozzles or orifices could be fitted at each tube and efficiency also increased by the insertion of agitators in the form of a twisted strip. Tests and research have shown many other possibilities for making unit heaters, convectors and heat exchangers more suited to high temperature water.

Any reader who may be interested in more than the foregoing highlights from available information on high temperature water may secure a wealth of detail by perusing the voluminous writings of E. A. Pearce on this subject. Such writings have been published in England in the 1949 Year Book of the Heating and Ventilating Industry; 1941 and 1943 Journal of the Institution of Heating and Ventilating Engineers; and in The Heating and Ventilating Engineer & Journal of Air Conditioning, May 1942, to and including Feb. 1943. Most of these references, with the possible exception of the 1949 Year Book, are out of print and can be obtained only through technical libraries.

Give a Thought to Variable Speed

F. H. RUMBLE
Texrope Drive Dept., Allis-Chalmers Mfg. Co.

ARE you interested in increasing the versatility of the machines in your plant? The variable speed V-belt drive may be your answer. In general, the variable speed drive is practical wherever a constant speed V-belt drive can be applied. And a variable speed drive can often be installed on existing machinery to make possible a higher production rate or lower manufacturing cost.

A few points should be taken into consideration to determine whether or not a variable speed drive can be used and if it can, which type is the most practical.

The factors involved include: Type of operation, type of driven machine, speed range required, horsepower of motor, when speed change is needed (when drive is in motion or stationary), the type of control needed, and the type and speed of motor.

Let us consider these factors in the light of an installation using an exhaust fan to draw fumes from a room. The speed range in this particular instance is from 475 to 575 rpm. The motor is a standard 15-hp, 1,800 rpm unit. Change is needed only infrequently and the drive may be stopped while the change is being made.

In the light of these conditions, a standard range, stationary control, variable diameter sheave fills all requirements in a variable speed drive for this application. Then, by consulting the manufacturer's pre-engineered drive tables, it is possible to determine the particular size standard range drive to fit all other requirements in the installation just stated.

Variable speed drive adjustable while in motion.

There is available to the plant engineer a variety of types of variable speed drives. Wisdom dictates that he select the one best fitted to fill all his needs at the lowest cost.

Table 1 lists six types of V-belt variable speed drives with speed range, horsepower capacity, size, type and method of speed change of each classified with typical applications.

TABLE 1—TYPES OF V-BELT VARIABLE SPEED DRIVES*.

Type	Speed Range	Horsepower	Belt Sections	Sizes and Grooves	Typical Applications
Adjustable sheave (Adjustable while drive is stationary)	Up to 50% Speed Increase	Fractional to 4	Standard A or B	10 sizes; 1 or 2 grooves	Light industrial drives; furnace and attic fans; stokers, small pumps, lathes, saws, tools and appliances.
Standard range, stationary control, Vari-pitch sheave (Adjust while drive is stationary)	Up to 28% Speed Increase	1 to 300	Standard A,B,C,D, or E	22 sizes; 2 to 12 grooves	Ventilating fans, pumps, and blowers, spinning frames, yarn covering machines; crushers, hammermills.
Standard range, motion control, Vari-pitch sheave (Adjustable while drive is in motion)	Up to 28% Speed Increase	1 to 300	Standard A,B,C,D, or E	21 sizes; 2 to 12 grooves	Fans, blowers, lathes, grinders, drills, solids handling pumps, circulating pumps, paper-making machines.
Wide range, stationary control, Vari-pitch sheave (Adjust while drive is stationary)	Up to 100% Speed Increase	1 to 60	Wide range belts, Q or R	6 sizes; 1 to 4 grooves	Spinning frames, twisters, bottle washers, conveyors, generators, machine tools, assembly line equipment.
Wide range, automatic Vari-pitch sheave (Adjustable while drive is in motion)	Up to 100% Speed Increase	1 to 60	Wide range belts, Q or R	5 sizes; 2 to 4 grooves	Pipe threaders, turret lathes, grain dryers, spinning frames, solids handling pumps, testing machines.

*Data applies to V-belt drives of Allis-Chalmers Mfg. Co.

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

This Month's Problem

The piping department that I have joined has some rubber lined pipe and valves that were installed because of a chemical manufacturing process. My previous experience has not been with such pipe lines. What are the operating precautions to be taken with rubber lined pipe and valves? What kind of inspection schedule, if any, should be followed?

THIS department is devoted to industrial plant problems presented for help and discussion. It is intended to be of service to the industrial plant engineer through technical assistance, and the exchange of information and experiences. Therefore, the editor welcomes problems from the industrial plant engineer that would be of possible interest to others. Also invited are letters regarding solutions to problems scheduled for discussion.

In the box on the top of this column is the problem considered in this issue. In the box on the bottom of the second column is the question that will be discussed in the coming issue.

Suggested Procedure

After a pipe line is installed, it is naturally very difficult to make any inspections on the inside of the pipe. Concerning the outside of exposed pipe, the precautions would be the same as for any other pipe line where corrosive fumes or splash might be encountered. Regarding pipe lined with soft rubber, the standard practice is to carry the rubber lining to within the inside of the bolt holes only, on the flange faces. Non-compressible gaskets are placed around the outside of the rubber covering, and when the flanges are bolted together, the non-compressible gaskets prevent over-compression of the soft rubber on the face of the flanges. The general construction for soft rubber lined pipe does not permit the rubber on the face of the flanges to be compressed more than 25%. It is important that these precautions be followed in assembling soft rubber lined pipe, for over-compression of the rubber on the flanges would actually crush the rubber lining.

When pipe is lined with flexible, hard or ebonite types of hard rubber lining, then the standard practice is to carry the hard rubber covering over the entire face of the flanges, and a soft rubber type gasket is used to make the seal. When such pipe is bolted together, one should see that the soft rubber ring type gasket is not compressed more than 25 to 50% to prevent possible damage.

In assembling either soft or hard rubber lined pipe, it is important that the bolts be drawn up uniformly a little at a time. In other words, one bolt should not be tightened to the utmost before other bolts are positioned. If lubricant is necessary, use flake graphite or other material which will not affect the linings.

One must remember that rubber linings and coatings are not structural materials and can be damaged by cables or slings, sharp instruments, impact and heat. Avoid physical damage from sharp bits of foreign material.

Do not operate at higher than design temperatures. Hard rubber linings should be protected against thermal shock. There should be provision for gradual heating or cooling. Where it is necessary to warm a solution to promote flow, this warming should be gradual and only up to the point necessary to promote this flow.

Avoid subjecting rubber linings to solvent type chemicals such as petroleum distillates, or more specifically, gasoline, kerosene, and oils; coal tar derivatives, as benzol and toluol; chlorinated hydrocarbons, as carbon tetrachloride and chlorbenzol.

When it is necessary to use a light for inspection, there should be proper lamp guards and care should be taken to prevent placing a bare light bulb from resting on the rubber.

Protect ebonite type linings from severe mechanical or thermal shock.

Do not alternate from one type service to another without first obtaining the approval of the company that supplied the rubber lining.

While inspection of the pipe is recommended, because of the difficulty in getting to the rubber lining, no definite inspection schedule is suggested.

The B. F. Goodrich Co.

Akron, Ohio.

(Continued on page 126)

Problem to be Discussed

October Issue

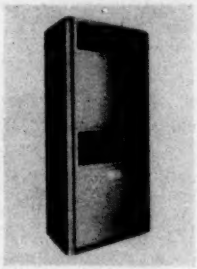
Considerable heat is carried away in winter by the air exhausted from paint spray booths. Providing that the paint pigment is removed, is it possible to recirculate part of the exhaust air? If so, what is the limit of recirculated air permitted in order to avoid the bad effect of paint fumes on workers?

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 104 for securing additional information on items described in this department.

Self-Contained Air Conditioner

A self-contained air conditioner in 3, 5 and 7½ ton capacities has been introduced by The Trane Co., La Crosse, Wis. The unit has been designed to save floor space, cut service and maintenance to a minimum, and is quiet in operation.



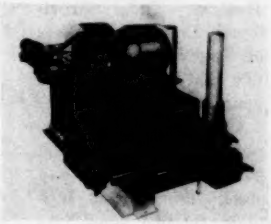
A vibration-muffling spring mounting of the compressor and glass fiber acoustic and thermal insulation of the streamlined casing contribute to quiet operation. The two-knob control panel in the front of the unit cooler permits the owner to set the desired temperatures, operate the unit for either heating or cooling, or use the fan alone.

Designed for use in stores, offices, apartments, factory spot installations, laboratories and drafting rooms, the conditioner is a complete packaged system, requiring only one electrical and three piping connections.

For more information, circle on Inquiry Card, **Item 1**

Stoker Feed Matches Load

Accurate adjustment of the coal-feeding rate to the load demand is being achieved by Iron Fireman Mfg. Co., Cleveland, Ohio, through its exclusive infinitely variable transmission on two of its Coal Flow stoker series.



An exclusive feature with its CF series stokers and PCF series Poweram stokers, the variable drive is particularly suited for use with modulating-type combustion controls. Infinite speed range is provided by a simple, durable mechanism that eliminates many of the service and adjustment problems characteristic of most variable speed drives.

Accessibility for servicing is achieved by mounting the unit above the conveyor worm. This also reduces the possibility of damage resulting from flooded pits and boiler rooms. An automatic overload device and torque indicator of spring scale accuracy is built into the transmission.

For more information, circle on Inquiry Card, **Item 2**

30 Amp. Load Interval Timers

A revised line of single-set timers for commercial and industrial service is available from The Tork Clock Co., Inc., Mount Vernon, N. Y. These timers may be had for either permanent installation or for portable use with cord and plug. Portable plug-in models are rated 6 amperes or 15 amperes.

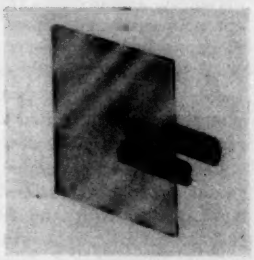
These heavy duty models provide selective switching where variable conditions make complete automatic control impractical. Additional features such as pilot lights, a signal circuit, by-pass switch, stop-switch and extra receptacles may be added if desired.

A single pole single throw, normally-open A.C. switch is timed and powered by a self-starting synchronous Telechron motor. Switches have heavy duty contacts of either 20 amperes or 30 amperes capacity. Compact in size, timers are enclosed in durable white or gray baked enamel cases, 4½ x 3 x 3 inches. Timing interval is easily set by turning indicator knob on dial. Various time cycles are available from 60 minutes to 24 hours.

For more information, circle on Inquiry Card, **Item 3**

Sheet Metal Door Fastener

Designed for fast easy application to sheet metal doors and panels, the Southco door latch made by South Chester Corporation, Philadelphia, Pa., features an exceptionally low purchase price and low installation cost. The latch consists of two brightly plated parts which fit together through a single hole drilled in the door panel. Installation is completed in a matter of seconds by twisting or flattening two prongs which join the handle and pawl; no rivets, bolts or welds are needed.



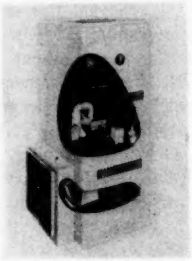
The fastener is supplied in two styles. Illustrated is the hand-operated model with protruding handle; a flush screwdriver operated head style is also available.

Coupling sturdy construction and ease of installation with low cost, this latch has found applications on hot water heaters, electrical and electronic equipment and other types of sheet metal cabinets and closures. Its use is widespread in places where cost has previously prohibited the use of a good industrial fastener.

For more information, circle on Inquiry Card, **Item 4**

Gas-Fired High Boy Furnace

To meet the demand for a heating unit for installation where space is tight, Richmond Radiator Co., New York, N. Y., has announced its Model SU-G, vertical, gas-fired, steel, winter air conditioner in two sizes. Both carry AGA approval for installation in closets or alcoves in the small ranch-type homes. One model has an input of 85,000 Btu per hour and the other an input of 110,000 Btu per hour.

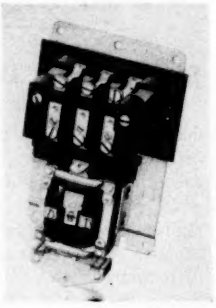


Bottom filter racks can be furnished as optional equipment at no extra charge. Other special features include: remote pilot igniter for convenience and safety in lighting burner from outside the furnace; and the mounting of burner and controls on a plate secured to the furnace by four nuts, thus permitting quick and easy removal of burner and controls for service.

For more information, circle on Inquiry Card, **Item 5**

Solenoid Contactors, N. O. or N. C.

Development of its 4458 Size O A C solenoid contactors is announced by Ward Leonard Electric Co., Mount Vernon, N. Y. These compact multi-pole contactors are designed for both load and control circuit use in controllers for refrigeration and air conditioning equipment and similar control applications.



Important features include: multi-pole unit construction, double break silver contacts easily converted to N.O. (normally open) or N.C. (normally closed) contacts, A.C. or D.C. power plants, solenoid-operated and complete accessibility of parts.

Contactors are available in 3 and 5 pole forms. The contacts which are housed in a molded melamine arc hood can be easily and quickly interchanged to form N.O. or N.C. poles. A maximum number of three N.C. poles can be obtained. Conversion can be made without additional parts, using only a screwdriver.

Maximum ratings are 2 hp, 440-550 volts, 3 phase, 60 cycle. Open 8 hr ampere rating is 15 amperes. Standard coils are available for 110, 220, 440 and 550 volt operation on 25, 50 or 60 cycles.

For more information, circle on Inquiry Card, **Item 6**

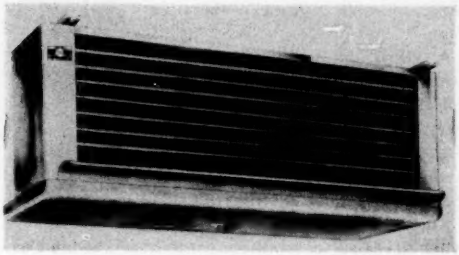
Acoustical Tile Improved

All of its Acousti-Celotex cane tile is now made with a washable finish, according to The Celotex Corp., Chicago, Ill. Applied in two coats directly to the board under pressure of a hot knurling roll, the coating becomes an integral part of the tile. The new finish is a tough, flexible coating producing sharply profiled perforations. Its texture is linen-like in appearance, giving better light diffusion than a smooth surface, although light reflection value remains the same.

For more information, circle on Inquiry Card, **Item 7**

Low Temperature Unit Coolers

Seven models of low temperature unit coolers using ammonia refrigerant and seven similar models using Freon have been placed into production by York Corporation, York, Pa.

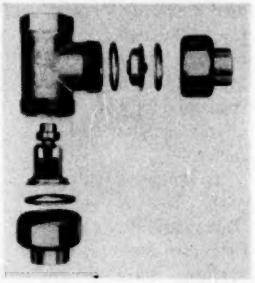


These new units are for applications requiring below freezing temperatures such as frozen food storages, fur storages, meat packing plants and ice-cream plants. They are compact and provide rapid defrosting by water spray. Unit coolers may be used in multiple where greater capacity is required.

For more information, circle on Inquiry Card, **Item 8**

Limits Hot Water Temperature

A tempering valve, Type B, to provide for delivering water to faucets or fixtures at a temperature of approximately 140 degrees is announced by Taco Heaters, Inc., Providence, R. I. The valve is an improved version of one introduced twelve years ago.



Constructed of phosphor and commercial bronze and stainless steel, the valve is supplied in two sizes, ½- and ¾-inch, so that it is suitable for most residential and small commercial installations. It is said to save call backs because it stretches tankless heater performance and guards against excessively hot water. It is a must in connection with dishwashing machines in that it prevents high temperature water from baking food particles on dishes.

The valve is a hermetically sealed thermostatic element and is equipped with two unions for easy installation.

For more information, circle on Inquiry Card, **Item 9**

Gas-Fired Gravity Furnace

Model GDS, new and improved gas-fired gravity furnace of 125,000 Btu input, has been added to the Janitrol line by Surface Combustion Corp., Toledo, Ohio.

Engineering emphasis has been placed on faster circulation and quieter operation. Thermostat sensitivity, coupled with fast response of the new Janitrol burner, delivers heat instantaneously. Glass wool insulation in jacket saves heat and deadens sound.

This new, compact gravity furnace permits the use of round or rectangular ductwork with an extended plenum, saving valuable basement space.

For more information, circle on Inquiry Card, **Item 10**

10 Hp Motor Starter

A 10 hp magnetic motor starter is announced by Furnas Electric Co., Batavia, Ill. It is neither a No. 1 nor No. 2 starter in the regularly designated size pattern, but an in-between size which has a definite price advantage. Heretofore, when a 10 hp starter was required, it has been necessary to buy the No. 2 size rated up to 25 hp, and to pay for this extra capacity.

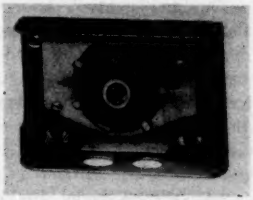
This series YE has renewable, rectangular type contacts of specially developed silver. Terminal boards are molded of arc-resistant alkyd and equipped with pressure connectors.

Measuring but 6¼ x 10¾ x 4¼ inches without sacrifice of wiring space, compactness is another advantage of this series over the No. 2 starter which is considerably larger in over-all size.

For more information, circle on Inquiry Card, **Item 11**

2-Speed Furnace Fan Control

Model FAF-15, a two-speed furnace fan control for use on gas-, oil- or coal-fired warm air heating equipment is being marketed by Crise Controls Division, Acro Manufacturing Co., Columbus, Ohio. It carries two separate electrical circuits having individual S. P. D. T. switches. When the furnace bonnet temperature rises to the low-speed fan setting, the fan will start operating at this speed and will switch to high speed only when the bonnet temperature reaches the higher setting. The action reverses as bonnet temperatures fall.

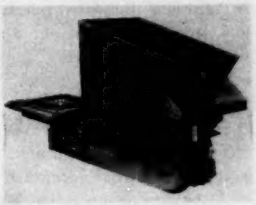


This unit features visible scale settings and temperature indication. It has a bi-metal helix temperature element made in insertion lengths up to 18 inches. The control case itself measures 5¼ × 3½ inches × 1¾ inches deep. It is available either with or without swivel mounting.

For more information, circle on Inquiry Card, **Item 12**

Redesigned Hopper Stokers

The deluxe commercial hopper model stokers made by Iron Fireman Mfg. Co., Cleveland, Ohio, have been refined to permit easier filling of the hopper and to avoid interference with boiler flue cleaning doors. Height of the hopper has been lowered and it is now fully open and sloping on the top, adding to the compactness and efficiency of design.



The hoppers are made in two sizes designed for use in warm air, steam or hot water systems and industrial applications. In these units a metering type worm takes the coal from the hopper to the fire in an unpacked condition, allowing easy penetration of air through the entire fuel bed. The coal burns on an air-cooled hearth from which fused residue is easily removed.

For more information, circle on Inquiry Card, **Item 13**

Compact Air Conditioner

A new, unusually compact year-round air conditioning unit designed especially for concealed installations in tourist courts, hospitals, hotels, small apartments, homes and offices, has been introduced by The Trane Co., La Crosse, Wis.

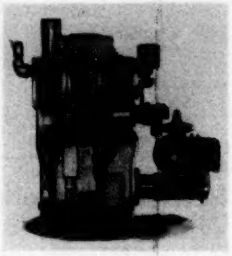
Suitable for either individual rooms, central systems, or the central zones of multi-room installations, this Type AA air conditioner is made in horizontal and vertical models with a wide range of coil combinations and motor arrangements. Requiring minimum service, it can be installed in furred ceiling spaces, closets, utility areas or normally-wasted floor or ceiling spaces.

Operating with chilled water and hot water systems, the units are available with base air volumes ranging from 200 to 600 cfm.

For more information, circle on Inquiry Card, **Item 14**

PB Series Gas-Fired Boiler

An AGA approved PB line of gas-fired boilers has been announced by Burnham Corp., Irvington, N. J. These boilers feature a new type quiet power burner which does not pop as it goes on. Controlled air and gas flow give positive combustion. Gas is burned completely in a short refractory tunnel under positive air pressure to give a high temperature, economical flame with low excess air.



All models but one in the line are available with built-in tankless domestic hot water heaters. Makers claim low pilot consumption, small heat loss accomplished without air dampers, tight boiler construction and efficient glass wool jacket insulation to cut water heating cost.

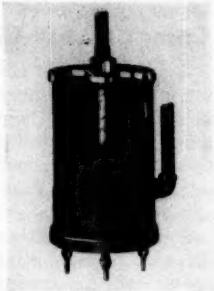
Boilers all feature vertical flue travel. Push button electric igniter and transformer relay, which are normally extras, are standard equipment on the PB line.

A 4-page descriptive folder with ratings and other data is available.

For more information, circle on Inquiry Card, **Item 15**

Compressed Air Drier, Filter

The Model B Condensifilter, a device which removes water, oil, sludge and other foreign materials from compressed air, is a new development of Hankison Corp., Pittsburgh, Pa. Combining in a single unit a dehydrating device, a mechanical filter and a self-purging trap, the device provides dry, clean compressed air for operating instruments. Measuring 15 in. high by 9 in. in diameter, it has a capacity of 30 cfm at 100 psi.



The device is recommended for purifying and dehydrating compressed air used in combustion and process control; in soaking pit, blast furnace and open hearth control; in the operating of boilers, pneumatic tools, paint spray, sand blast and laboratory equipment; and in the operation of agitation equipment in food and chemical processing and in electroplating.

In operation, air is admitted through the side, directed through the condensing section where it is dehydrated, and then passed through the mechanical filter. The condensing unit, which removes water in both entrained and vapor states, is composed of a series of copper coils through which cold water flows.

When requirements are greater than the rated capacity of a single unit, the units may be installed in parallel. The same applies when uninterrupted service is desired, for the parallel arrangement allows one unit to be cleaned while the other carries the load.

For more information, circle on Inquiry Card, **Item 16**

Ceiling Panels for Radiant Heat

A type of ceiling affording radiant heating and cooling as well as acoustic control is being produced by Burgess-Manning Co., Chicago, Ill. It is intended for remodeling or new construction in offices, institutions, public buildings and homes.

The ceiling consists of perforated metal panels heated by hot water. Blankets of acoustical material above the panels provide acoustical control, thermal insulator, and vapor barrier.

Advantages of the ceiling are that it keeps the floor at room air temperature, it is easily installed and maintained, affords maximum availability to services located behind the ceiling, and has a pleasant, tile-like appearance.

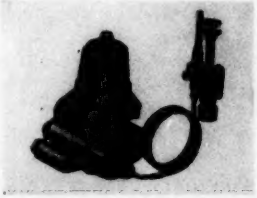
Higher temperatures than used in ordinary radiant panel heating systems are said to be possible, and a much faster warm-up period results in contrast to systems where heating coils are buried in plaster or concrete.

The ceiling may be installed by local contractors, but the essential elements are prefabricated and engineering service is provided by the manufacturer.

For more information, circle on Inquiry Card, **Item 17**

Gas Valve for Space Heaters

A modulating thermostatic gas valve for space heaters is announced by Appliance Controls Div., Minneapolis-Honeywell Regulator Co., Los Angeles, Calif. The valve combines a bellows thermostat, valve, minimum flame adjustment, and safety pilot in one compact, economical unit.



The built-in- thermostat varies the positioning of the control valve according to room temperature. This provides a modulating burner flame which ranges from full volume to a pre-set minimum flame. The safety pilot gives complete shut-off in case of pilot failure.

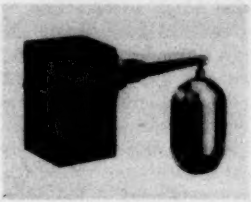
The new control, known as the V5163 Honeywell thermostatic gas valve, is suitable for use with natural, mixed and L. P. gases, and is intended to provide comfort and convenience for small homes, cabins, cottages and wherever gas space heaters are used generally. It also can be used in many commercial applications, including incubator houses, brooder houses and tobacco curing heating units.

An optional model, the V5140, is available without safety pilot.

For more information, circle on Inquiry Card, **Item 18**

Signal Switch, Fuel Cut-Off

A float-operated signal switch device or fuel cut-off, designed to operate on pressures from vacuum to 450 lb, is announced by Reliance Gauge Column Co., Cleveland, Ohio. Redeveloped from a signal switch device marketed first in 1948, the new unit, designated as Levalarm EA-10 is heavier and embodies improved construction features.

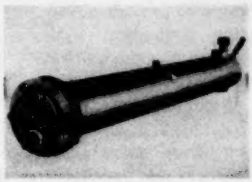


As a signal switch, the device is used to set off warning signals such as bells, sirens or lights when liquid levels in small boilers or various types of tanks reach predetermined low or high points, or it can be used as a fuel cut-off for low water. In conjunction with water columns, the float lever is inserted into the alarm valve opening.

For more information, circle on Inquiry Card, **Item 19**

Triple Tested Oil Preheater

An oil preheater, called Safe Guard, which protects against contaminating of boilers and heating systems, is announced by The Alstrom Corp., Bronx, N. Y.



The preheater is a double transfer unit that has been triple-tested to guard against leaking oil tubes. It is claimed to give uniform heating, is compact, ruggedly constructed and has an attractive finish. A visual indicator, standard equipment on all models, warns of oil leaks.

The preheaters are available for both below-waterline and vacuum installations in a full range of sizes.

For more information, circle on Inquiry Card, **Item 20**

Steam Pressure Regulator

The Model SC-B Master regulator for steam control is being marketed by Cleveland Fuel Equipment Co., Cleveland, Ohio. The control can be successfully applied wherever it is necessary or desirable to hold steam pressure at a certain prescribed level. Application is for process steam production where constant pressure must be maintained despite varying load demands. It is designed to give accurate, automatic regulation of steam pressure on any type of stoker-, gas- or oil-fired boiler.

The device is designed to be installed in conjunction with the company's Lectricarm drive unit. It provides automatic modulation of fuel and air supply in direct proportion to pressure changes. The regulator is effective in cutting fuel costs on stoker-fired heating boilers, where intermittent operation causes excessive smoking during off-periods.

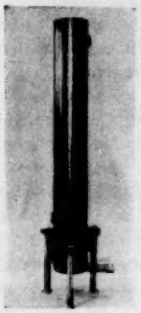
The control will save fuel in at least three ways: By holding steam pressure to exact requirements, it eliminates over-firing; by modulating fuel and air supply in the correct ratio, it maintains high combustion efficiency; and by eliminating start-and-stop firing, it prevents unnecessary boiler and stack heat losses.

Units are available for wide selection of pressure range requirements.

For more information, circle on Inquiry Card, **Item 21**

Industrial Water Heater

Development of an industrial water heater which automatically sets a safe hot water temperature for washroom use, without mixing with cold at the faucets and thus eliminating the danger of scalding, has been completed by T. G. McCann Co., Inc., Pittsburgh, Pa. The porcelain enamel-lined storage tank type heater is designed for heating from existing plant steam systems, and maintains all the advantages of instantaneous heaters while eliminating the undesirable features such as manual temperature regulation in the washroom, and overheating. Steam coils are completely submerged in the tank, and regulated by a control bulb located directly in the body of the heater where it is immediately affected by the slightest change in temperature. A water temperature of between 100 and 120 deg is constantly maintained.



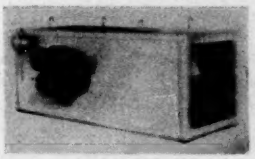
The porcelain enamel lining is a .010 inch glass-like coating fused to the steel which permanently resists corrosive influences.

Low temperature maintenance is also reported to limit the deposits of hard water precipitants.

For more information, circle on Inquiry Card, **Item 22**

Small Size Oil-Fired Lowboy

A small size suspended-type oil-fired winter air conditioner for installation in crawl spaces, attics, or closets of small homes has been introduced by York-Shipley, Inc., York, Pa.



The unit, completely packaged, has a capacity of 90,000 Btu per hour at the bonnet and is enclosed in a white casing 23 inches square and 59 inches long. It weighs 483 lb.

The iris shutter burner, which is standard on all of the company's units, is equipped with an 0.87 gph nozzle.

For more information, circle on Inquiry Card, **Item 23**

Remote Room Air Conditioner

A line of remote room air conditioners is available from Marlo Coil Co., St. Louis, Mo. Designed for cooling, heating, ventilating and filtering in such multi-room installations as those in hotels, apartments, office buildings, hospitals and other institutions, the Model FWC remote room air conditioning units are an answer to the problem of installing in existing buildings where space or cost of duct systems is prohibitive, or in new buildings where the number of units required may be more economically installed in preference to a central air conditioning system.

Units are equipped with filters, fans, coils, motor, and drain pan. Cabinet is constructed of heavy furniture steel, modern in design, and finished in attractive baked enamel colors that harmonizes with any interior scheme.

The units are available with hot or chilled water coils, direct expansion refrigeration coils, steam coils and various combinations of these coils.

Advantages offered by these unit are: Complete flexibility of installation—for new or remodeling work. Can be installed a wing or floor at a time, without disrupting normal building traffic or occupancy; no ductwork is needed; and individual comfort control for each room or unit. Bulletin 1149 is available.

For more information, circle on Inquiry Card, **Item 24**

Slide-Rule Heating Calculator

The Heating Calculator, a plastic pocket size slide-rule, has been announced by the Calculator Specialties Co., Chicago, Ill. It can be used to figure gravity or

forced warm air jobs as well as hot water and steam radiator installations.

Heat losses through walls, glass doors and roofs can be calculated by both short cut and long methods. The rule permits the engineer to use his own calculation method in solving a problem instead of calling for set plan of procedure. The slide-rule is priced at $4.

For more information, circle on Inquiry Card, **Item 25**

Incinerator for Large Jobs

Redesigning of its standard rubbish destructor is announced by Plibrico Jointless Firebrick Co., Chicago, Ill. It has a Multi-Rib steel casing said to be so strong that it reduces the weight of the steel casing and structural framing, permitting the erection of a steel-cased incinerator at a cost no greater than ordinary solid brick construction. All of the advantages of steel-cased construction are retained, such as cleanliness, compactness, durability, and minimum maintenance.

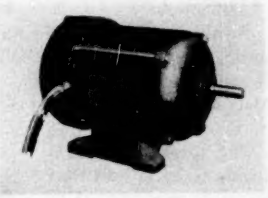
The incinerator is lined with Plicast castable refractory material and is adequately insulated to protect the steelwork and paint. Designed to consume industrial and institutional waste, such as waste paper, cartons, floor sweepings and wood scrap, etc., the incinerator is erected in four standard sizes rated at 500, 1200, 2200, and 3,500 lb per hr.

For more information, circle on Inquiry Card, **Item 26**

Totally Enclosed Small Motors

Its Tri-Clad line of single-phase capacitor motors has been extended to include a totally enclosed fan-cooled construction, according to the Small and Medium Motor Division, General Electric Co., Schenectady, N. Y.

Features of the new design include starting capacitors and switch mounted within the frame to provide maximum protection with minimum space requirements.



Available in ratings of 1, 1½, 2, 3, and 5 hp, the new line was developed for use where extra severe conditions of dirt, grit, or moisture are encountered. It is also offered in explosion proof and dust-explosion proof construction for installation in hazardous locations. Typical applications are: coal stokers, exhaust fans, grain elevators, and fuel pumps.

Of cast iron construction, the new motors feature the standard Tri-Clad protection against physical damage, electrical breakdown, and operating wear and tear. Being capacitor motors, they have no brushes or commutators to interfere with either radio or television reception.

For more information, circle on Inquiry Card, **Item 27**

Fast, Accurate Flow Meter

A new type of flow meter which has functional design, gives fast and accurate response over an entire range and features low initial cost and maintenance has been developed by Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Philadelphia, Pa.

The new meter includes such advantages as an evenly graduated meter scale and electronic integration. It is available either as a mechanical flow meter with integral recorder, or as an electrical transmitter to be used with a Brown inductance bridge receiver.

For more information, circle on Inquiry Card, **Item 28**

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**
- **New Catalogs**

Circle the Item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

TRAPS, VALVES, AND SPECIALTIES

A handy selection guide to its complete line of traps, valves, and other specialties for steam and hot water heating installations has been issued as Bulletin 1501, by C. A. Dunham Co., Chicago, Ill. Bulletin outlines the outstanding design and construction features of more than 20 specialty items; gives complete range of applications for a variety of operating conditions; includes essential capacity, weight and dimensional data in simplified, easy-to-read tables. Cross-sectional drawings and photographs illustrate operating characteristics of every item. .....Item 29

BLOWER WHEELS

A 28-page databook, Bulletin 503, has been issued by Morrison Products, Inc., Cleveland, Ohio, and devoted to the company's line of blower wheels. Full data and dimensions, construction, as well as complete capacity and performance data, are given in tables and graphs. Item 30

ROOF VENTILATORS

The company's line of Air-X-Hausters are described in an 8-page catalog published by G. C. Breidert Co., Los Angeles, Calif. Test data and descriptive matter relating to the company's roof ventilators are included. .....Item 31

FORCED DRAFT FAN DATA

An 8-page illustrated bulletin, No. 300, describing the design features of its forced draft fans, is offered by Pratt-Daniel Corp., Port Chester, Conn. Booklet illustrates various types of fan-wheels and housings. .....Item 32

COOLER FOR QUENCH OIL

Bulletin D-350-2 has been issued by Trane Co., La Crosse, Wis., covering its equipment for evaporative cooling of quench oils. The bulletin tells how cooling and circulation of quench oils assures scientific control and saves time by continuous operation, in addition to reducing oil losses and fire hazards. Included in the bulletin are suggestions for control of quench oil cooling systems, and selection, capacity and dimension data. ....Item 33

STEAM TRAP SELECTOR

A clear, concise method of presenting data to help in the selection of steam traps for industrial use is contained in Bulletin T-1750, released by Yarnall-Waring Co., Philadelphia, Pa. This 20-page bulletin lists the various process and industrial equipment and then presents information pertinent to the proper selection of necessary traps. It also contains a table on capacities of Yarway traps in pounds of condensate discharged per hour. .....Item 34

CONDENSATE RETURN UNITS

An easy-to-use selection table, in the 6-page catalog, Section 212, of Roy E. Roth Co., Rock Island, Ill., enables rapid and accurate selection of the correct Roth vertical condensate return unit to fit specific needs. This table gives capacity in square feet of radiator, capacity in gpm, receiver capacity in gallons, and range of models according to boiler pressure. Complete specifications for pump, receiver, motor, and accessories are included, with all installation dimensions shown graphically. .....Item 35

BOILER CONTROLS

The current condensed catalog of McDonnell & Miller, Chicago, Ill., is supplemented by a 20-page catalog which covers products not presented in the company's condensed catalog. It contains interesting and useful data about liquid level controls with special applications, float controls and related devices. Data are valuable in solving special boiler water level control problems. .....Item 36

CONDENSATE METERS

A 4-page bulletin, No. R-513, issued by American District Steam Co., Inc., North Tonawanda, N. Y., explains design, construction, installation and operation of the Adsco rotary condensate meter. Bulletin includes size, dimension and weight table, and simplified piping diagrams for both gravity and vacuum systems. Illustrated with photos of typical installations, cutaway drawings of rotor operation and construction sketches. .....Item 37

LIQUID CHILLERS

Bulletin 640, on UX and UXR liquid chillers, has been published by Acme Industries, Inc., Jackson, Mich. This brochure covers liquid chilling units with fixed and removable type tube bundles. The units are used for chilling liquids such as water, oil, and alcohols. Bulletin furnishes helpful information on specifications, selection procedure, heat transfer data, outline drawings and a schedule of dimensions. A table giving factors for determining the mean effective temperature difference is included. .....Item 38

ALLOY STEEL TUBING

Assistance in solving problems involving the use of alternate grades of medium carbon, or full hardening, grades of tubing steels, is offered in a new four-page bulletin published by The Babcock & Wilcox Tube Co., Beaver Falls, Pa. Known as Bulletin TDC 141, it presents condensed data on microstructure, critical points, effect of alloy elements, forging, machining, welding and thermal treatment for 14 alloy steels used in the production of tubular parts. .....Item 39

ECONOMY IN USING STEAM

How Increasing Your Steam Costs Can Save Money is the title of booklet 2171 available from Sarco Company, Inc., New York, N. Y. It consists of 16 questions and answers written in easy-to-read style for executives in the industrial and heating fields. The value of the booklet is increased by the fact that it does not try to sell. In answering the 16 questions, only once does the author mention the products of his company. .....Item 40

FREON COOLERS

A most attractive catalog, No. 101, in color, and entitled PK Freon Coolers, Dry Expansion Type, has been published by Patterson-Kelley Co., Inc., East Stroudsburg, Pa. Coolers are described, illustrations given for calculating the capacity needed, and well presented and easily followed capacity and specification data are included. .....Item 41

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MULTI-ROOM AIR CONDITIONING

Design, selection and operating data on the one circuit budget UniTrane unit for multi-room air conditioning systems is featured in bulletin DS-420, published by The Trane Company, La Crosse, Wis. The 40-page handbook includes complete data on both the budget OC-UniTrane system and the deluxe MC-UniTrane system, designed to provide individual room control of air conditioning in offices, hotels, hospitals and other multi-room buildings. .....Item 42

DAMPER AND SHUTTER BROCHURE

Dampers and shutters for heating, air conditioning, ventilating and industrial applications, locomotives, buses, trucks and transit vehicles are described in a brochure issued by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. It also describes the company's line of motor operating units that accurately position dampers in response to temperature or pressure controllers. .....Item 43

CONCENTRATORS

Bulletins 118 and 119 have been issued by Niagara Blower Co., New York, N. Y. and covering its Niagara concentrator for use in process and food storage spaces by taking care of the latent heat load. .....Item 44

STEAM TRAPS

A 32-page profusely illustrated catalog, No. 751, has been issued by W. H. Nicholson & Co., Wilkes-Barre, Pa., covering its line of steam, air and gasoline traps, including five types of thermostatic steam traps, two types of expansion steam traps, three types of weight-operated traps for steam and air, piston operated steam traps, and three types of steam, air and gas separators. The catalog is complete with capacity tables and installation diagrams, as well as a section containing data, charts and formulas for determining the proper size trap for specific applications. .....Item 45

OXYGEN RECORDER

Available from Hays Corp., Michigan City, Ind., is the functionally designed, fully indexed Magno-Therm oxygen recorder bulletin 51-829. Divided into five sections, it includes an introduction, explanation of how an analysis is made utilizing the paramagnetic properties of oxygen, a diagrammatic explanation of the operation, various gas sampling systems used with the instrument, and chart-illustrated discussions of results obtained with the recorder. .....Item 46

OIL, GAS BURNER PARTS CATALOG

A 142-page manual for the service departments of oil burner and gas burner dealers and heating contractors has been issued by R. E. Michel Co., Inc., Baltimore, Md. The manual is a catalog of practically everything that is used in connection with oil or gas heating, including controls, and contains not only part and price information but prices on rebuilding or exchange of parts. .....Item 47

PIPE HANGER CATALOG AND DATA

Catalog 51, devoted to its pipe hangers, vibration eliminators and supports, has been issued by Blaw-Knox Co., Pittsburgh, Pa. The catalog, standard size, has 96 pages and is complete with specifications, descriptive data and numerous illustrations, as well as engineering data for selecting this equipment. .....Item 48

STAINLESS STEEL HANDBOOK

A new data and handbook on stainless steels has been published by Allegheny Ludlum Steel Corp., Pittsburgh, Pa. In its 120 pages the cloth-bound volume discusses approximately 40 different types of Allegheny Metal stainless steel and covers each type from standpoints of analyses, fabrication, heat treatment and special conditions of service. .....Item 49

HOUSE VENTILATION MANUAL

An informative manual called A, B, C's of Ventilating Fans has been produced by NuTone, Inc., Cincinnati, Ohio. It is designed for architects, builders and contractors, and features home ventilation. .....Item 50

LARGE INCINERATORS

A 16-page catalog covering its incinerator line is offered by the Plibrico Jointless Firebrick Co., Chicago, Ill. Catalog covers the rubbish incinerator erected in four standard sizes rated at 500 to 3,500 lb per hr; also the portable incinerator made in four sizes from 135 to 450 lb per hr. Also described are special incinerators for garbage and cafeteria refuse, biological and pathological material, wood refuse, and special applications. .....Item 51

PERIMETER HEATING MANUAL

A 36-page text on perimeter heating application and installation has recently been made available by The Lennox Furnace Co., Marshalltown, Iowa. It was written by Frank Osborn, chief application engineer of the company. Written in an easy-to-read style, the manual points out the advantage of perimeter heating over other methods and tells in detail how to plan, layout and install a perimeter heating system correctly in slab floor homes, crawl space homes and basement homes. It is profusely illustrated throughout and devoid of advertising. Printed on heavy enameled paper with a durable brown and gold cover. Price, 75 cents. .....Item 52

STEAM TRAP CONDENSED CATALOG

A 12-page condensed catalog giving data and prices on its steam traps and air traps has been issued by Armstrong Machine Works, Three Rivers, Mich. It lists cast semi-steel and forged steel inverted bucket traps, compound steam traps, ball float air traps, Y-type strainers and internal check valves. There are four pages of data on calculation of condensate loads and selection of traps to handle these loads, including a full page for a steam trap capacity chart. A parts list is included for bucket traps. Item 53

HEATING EQUIPMENT TRANSFORMERS

A new two-color, eight-page bulletin, GEA-5599, on ignition transformers for domestic type automatic oil- and gas-fired heating equipment is available from General Electric Co., Schenectady, N. Y. It covers SM (standardized manufacture) models of the mid-point grounded design, equipped with built-in two-way self-shielding to suppress radio and television interference. It describes the design and construction features of the transformers and discusses the benefits of standardization, facts on radio and television interference, and advantages of two-way self-shielding. .....Item 54

HEAT AND VAPOR FLOW MANUAL

A new revised and expanded edition, 56 pages, of Simplified Physics of vapor and Thermal Insulation has been issued by Infra Insulation, Inc., New York, N. Y. Written by Alexander Schwartz, president, the booklet provides information on heat transfer through buildings, and includes a chart of thermal insulation values, a feature of previous editions, amplified and made more easy to use. A chart of radiation and emissivity of materials, presenting in one table information gathered from many sources on the absorptivity and emissivity of a large list of materials, is presented. A convenient index is included. .....Item 55

MOTOR STARTERS

An eight-page folder, illustrating and describing its new line of Explo-Safe and Weatherproof motor starters for hazardous locations, has been issued by the Industrial Control Div., The Arrow-Hart & Hegeman Electric Co., Hartford, Conn. Folder gives complete information, including dimensions, weights, ratings and wiring diagrams for these magnetic across-the-line starters which the manufacturer claims are smaller and lighter than conventional motor starters. .....Item 56

VERTICAL TUBINE-TYPE PUMPS

An 8-page catalog, No. 7228, which describes its Class APH-APK line of vertical turbine-type pumps, is available from Ingersoll-Rand Co., Phillipsburg, Pa. These pumps are particularly applicable to bulk liquid transfer, cooling tower, dewatering and similar services where suction is from an open source. .....Item 57

ONE COAT INSULATING CEMENT

A folder on its Powerhouse cement has been issued by Baldwin-Hill Co., Trenton, N. J. This is a finishing cement which also insulates and which, according to the manufacturer, is needed in only one coat. .....Item 58

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58		

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PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Big Electric Motors Pump Oil for Defense

PROBLEM: The Basin Pipe Line System of the Texas Pipe Line Co., Houston, Texas, was required to add 100,000 barrels per day to the pumping capacity of the 515-mile pipe line system which delivers crude oil from west Texas to connecting carriers at Cushing, Oklahoma.

SOLUTION: The largest electric motors and pumps ever built for oil pipe line pumping service are now being installed. Eight 3,000-hp, 1,780-rpm induction motors will drive huge centrifugal pumps in four stations of the line, and seven similar 1,250-hp units will aid in boosting capacity of the line to the new requirements. These 3,000-hp motors, supplied by Electric Machinery Mfg. Co., Minneapolis, Minn., use pressure-lubricated bearings and are fully enclosed for ventilation from a filtered fresh air source. They are designed for starting at full voltage at extremely low current.

RESULTS: Capacity of the pipe lines will be increased with a minimum number of mechanical units. Special starting characteristics of motors will minimize disturbance to the power systems.

Comfort-Cold Storage Combined in Produce Store

PROBLEM: One of the time-consuming and expensive jobs in the retail fruit and vegetable produce business is the requirement for nightly transfer of perishable merchandise from retail areas to cold storage facilities and the reverse chore of setting up displays in the morning. A similar difficulty is encountered in stock rooms handling the transfer of goods from shipping containers to retail areas. The problem of wilting of both produce and personnel during long hot summer days also plagues the industry.

SOLUTION: Smilen Brothers, Inc., chain of fruit stores in New York City, claims the distinction of being the first company in the country to air condition throughout produce stores and still maintain the open front feature common to this type of establishment. By installing oversize packaged Typhoon air conditioning units, the company manages to convert its comfort air conditioning system into cold storage equipment at night. Instead of packing up all the produce at the end of the day and placing it in cold storage for the night, the air conditioning equipment is left running throughout the night and the produce left in place on the racks. The closing of doors and windows at night, changes the load on the system so that the entire store can be kept at night between 58 and 62F with only slightly oversized equipment. Two 5-ton units are used to perform the dual job where a 7½-ton unit would be needed for comfort cooling alone. Most Smilen stores are roughly identical with a 15 x 40 ft selling area and 15 x 40 ft stock room. The selling area is air conditioned by one unit and the stock room by another of the same size which also acts as a booster for the selling area when the store front is open.

RESULTS: By using two 5-ton air conditioners instead of one 10-ton unit, flexibility is gained so that on spring and fall days only one unit may suffice. The labor and time involved in moving produce to and from the storage room is eliminated. Selling can continue right up to closing time. Morning preparation time is greatly reduced. Handling and constant damage to fruit is minimized. Employees and customers are more comfortable and sales consequently increased.

Window Unit in Transom Cools Store

PROBLEM: Robert Vierthaler, who operates a small jewelry store at 604 Federal Street, Pittsburgh, was in need of air conditioning not only because of intense summer heat but also because dust accumulated on his precision instruments and gages when he left the door open for ventilation. There was no water supply or drainage facilities and no space or windows in which to install air handling machinery.

SOLUTION: An air conditioning survey revealed that about 1 ton of refrigeration would handle the load. A Frigidaire representative suggested that a standard sized transom over the front door be used to accommodate a 1-ton capacity Frigidaire window room air conditioner. The unit contains two complete meter-miser refrigerating systems.

RESULTS: On especially hot days, both systems are operated, while during normal summer weather, one compressor supplies enough capacity to do the job. Because the unit is equipped with automatic moisture disposal, there is no danger of excess moisture dripping on customers as they come through the door. None of the limited commercial space is occupied by air conditioning equipment.

Plant Zoned by 50 Electric Heaters

PROBLEM: At the new 196,000 sq ft factory addition of McCulloch Motors, Los Angeles, manufacturer of chain saws and gasoline engines, uneven distribution of heating load and intermittent requirements in some areas favored the use of multiple heaters with a high degree of flexibility.

SOLUTION: Operating on the premise that better heat distribution at lower cost results from having a large number of small units strategically spaced, 108,000 sq ft of this area was divided into zones of maximum and minimum heat losses, and 50 Kilbury blower-type electric heaters, 13 kw (45,000 Btu) capacity each, were installed.

The outside cold bays and entrances were assigned more than half the units, and the remainder warm the inside bays where only ceiling losses occur. Each unit is equipped with individual thermostat for zone control, and heats independently or in unison with other units. The units have high-velocity blowers designed to put heat down on the floor through vertical ducts or by free throw. The heat is mixed with the cold air on the floor, minimizing warm air stratification and roof heat losses. The bases of heaters are 9 ft above the floor, and wherever possible the inside channels of steel I-beam columns are utilized for shielding the ducts.

RESULTS: Uniform heating over a wide area or spot heating by zones is achieved at low cost.

Sludge Cleaned from Oil Tanks

PROBLEM: Bunker C fuel oil storage tanks tend to accumulate a deposit of muck and sludge which is difficult to remove. Previous cleaning practice had been to flood the compartments with distillate, allow it to soak in for an hour, then pump out the distillate and send a man, suitably equipped with safety suit, air supply, and safety ropes into each compartment to flush out the softened residues. The sludge did not respond completely in the solvent action of the distillate and the actual cleaning job was far from adequate, particularly in view of the difficulty of effective removal of loosened deposits by a worker handicapped by the safety clothing, helmet, etc.

SOLUTION: A new method is based on the use of Magnusol HD, an emulsifiable solvent cleaner manufactured by the Magnus Chemical Co., Garwood, N. J. The material has been used in industry for degreasing, and it was thought that considerable savings in cleaning costs would result if a method could be devised for using it on Bunker C sludge. The Magnus cleaner was mixed with distillate, and the mixture sprayed inside the tank by a man suitably protected with safety clothing and air supply. The surfaces were then flushed off with water under pressure.

RESULTS: The residues were removed completely by one spraying of the Magnusol mix and flushing. Repeated tests show that one man can thoroughly clean out a compartment in less than a half hour.

Automatic Control Solves Moisture Problem

PROBLEM: At the Sierra Talc and Clay Company, Los Angeles, clay is dried in a 65-ft-long rotary kiln at temperatures from 180F to 1220F. This clay is used in the preparation of Adsorbol, trade name of an important product for the decolorizing of vegetable, marine and animal oils. It is important that uniform moisture content be maintained.

SOLUTION: Temperatures are sensed at the outlet stack of the kiln with an iron-constantan thermocouple and are measured, recorded and controlled by a Wheelco Model 7001 Capacilog strip chart recorder with a scale and chart range of zero to 800F. To achieve accurate control, an Xactline is incorporated into the system to eliminate thermal lag.

RESULTS: Particle size distribution of the product had been adversely affected by extreme variations in moisture content under old style manual controls. The present system has overcome these difficulties and the kiln now requires less attention.

Hospital Buys Air Conditioning in Packages

PROBLEM: The Mercy Hospital in Hamilton, Ohio, required air conditioning but did not have sufficient finances for a complete job.

SOLUTION: It was decided that progressive expenditures for self-contained units could be met from time to time to gradually build up a complete air conditioning system. The hospital has air conditioned its two operating rooms with packaged units installed in a brick penthouse on the hospital roof directly over the operating rooms. Two 5-ton self-contained Frigidaire air conditioners were installed face to face in this penthouse as shown in the photo. Owing to anesthetic fumes, 100% fresh air is cooled and introduced into the operating rooms.

RESULTS: Prior to installation of air conditioning, surgeons had been operating with room temperatures running up to 95F and a nurse was required frequently for the sole duty of keeping the attending surgeon's face free of perspiration. Operations had been previously scheduled during cooler morning hours whenever possible. After installing air conditioning, operating conditions were more comfortable and schedule more flexible. Attendants say that the patient does not lose body fluids as fast as before. Filtering incoming air provides more sterile conditions. Hospital officials found they could have air conditioning where it was most needed and later expand the system to include remainder of the wing.

NEWS OF THE MONTH

MARYLAND GAS REGULATION

relieves state of restrictions imposed by Petroleum Administration for Defense.

Asserting its right to regulate intrastate use of natural gas, the Maryland State Public Service Commission adopted a resolution Aug. 16 relieving the state of restrictions imposed by the Petroleum Administration for Defense.

• **AUTHORITY.**—The resolution certified to the President that the Maryland PSC "has authority to restrict the use of natural gas and that it is exercising that authority to the extent necessary to accomplish the objectives of the Defense Production Act of 1950."

Federal measure provides for exemption of states from natural gas regulation by the federal agency upon proper certification of authority to the President.

• **RESULT.**—Effect of the resolution was to remove Maryland from the new federal curbs on installation of new home and space-heating equipment originally applicable to 15 states and the District of Columbia.

Although the state commission has authority to adopt similar restrictions, there was no immediate indication of its intention in this respect.

AIR CONDITIONING SALES

show sharp gains in 1950 as reflected by census figures on shipments.

Shipments of components and accessories for air-conditioning and commercial refrigeration equipment in 1950 were valued at $196 million, up 48% over 1949 and only slightly below 1947 peak shipments of $204 million. This increase in value of shipments was shared by all four major classes of components and accessories for air conditioning and commercial refrigeration equipment included in a Census Bureau report. Condensing units showed an increase from $54 million in 1949 to $74 million in 1950, a gain of 39%. Compressors and compressor units, valued at $30 million in 1949, increased 57% to $47 million in 1950. Centrifugal refrigeration systems were valued at $12 million in 1950, up 50% over 1949, and the value of heat-exchanger equipment shipped in 1950 amounted to $62 million, an increase of 52% over the preceding year.

• **UNITARY EQUIPMENT.**—Shipments of self-contained air conditioning units amounted to $85 million in 1950, a gain of 68% over 1949. The value of shipments of ice-making machines totaled $7 million.

TABLE 1.—SHIPMENTS OF AIR CONDITIONING AND REFRIGERATION EQUIPMENT, 1946 TO 1950.

(Value figures in thousands of dollars)

Class of product	1950		1949*		1948		1947*		1946	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Condensing units	858,367	$74,483	610,341	$53,534	841,609	$73,443	1,039,772	$98,296	755,538	$55,379
Ammonia refrigerants	245	352	254	346	1,129	1,799	1,646	2,107	1,409	1,464
Refrigerants, except ammonia	858,122	74,131	610,087	53,188	840,480	71,644	973,093	90,224	754,129	53,915
Air-cooled	807,693	57,685	570,280	40,127	797,098	56,829	924,553	73,742	712,781	40,340
Water-cooled	50,429	16,446	39,807	13,061	43,382	14,815	48,540	16,482	41,348	13,575
Compressors and compressor units	954,368	46,977	604,431	29,929	459,390	33,493	n.a.	34,586	191,770	15,377
Ammonia refrigerants	2,652	6,756	2,240	5,620	4,156	9,209	4,415	9,481	3,176	5,862
Refrigerants, except ammonia	951,716	40,221	602,191	24,309	455,234	24,284	313,682	20,148	188,594	9,515
Centrifugal refrigeration systems	382	12,249	285	8,189	361	10,351	313	7,814	312	6,593
Heat-exchanger equipment	.....	62,008	.....	40,925	.....	48,552	.....	63,025	.....	40,451
Evaporative condensers	7,818	8,869	4,798	5,850	5,560	7,505	n.a.	7,875	4,859	4,957
Unit coolers	152,996	26,223	95,850	15,707	102,825	17,874	n.a.	20,167	190,552	18,203
Air conditioning	49,400	13,306	30,044	7,997	21,633	8,276	n.a.	6,208	9,551	3,880
Refrigeration	103,596	12,917	65,806	7,710	81,192	9,598	n.a.	13,959	181,001	14,323
Other heat-exchanger equipment	.....	26,916	.....	19,368	.....	23,173	.....	28,246	.....	17,291
Self-contained air conditioning units	249,854	84,842	123,709	50,584	111,620	49,008	74,976	39,509	47,664	19,500
Room-type	193,807	33,958	89,320	17,940	73,638	15,503	42,904	9,930	29,835	5,870
Other than room-type	56,047	50,884	34,389	32,644	37,982	33,505	32,072	29,579	17,829	13,630
Ice-making machines	11,846	7,203	6,902	4,641	5,947	5,266	7,822	3,122	n.a.	n.a.

*Revised.
n.a. Not available.

• **SCOPE OF SURVEY.**—The figures on quantity and value of shipments in this report represent completed sales of equipment, i.e., units actually billed and shipped. Complete units delivered on consignment or shipped to a branch warehouse for stock are not included until such time as they are actually sold. The dollar values shown are the manufacturers' net billing prices, f. o. b. factory.

The report includes data for virtually every company manufacturing components and accessories for air conditioning and commercial refrigeration and complete air conditioning equipment. The 1950 figures are based on reports received from 98 companies.

Table 1 presents a historical summary of the quantity and value of shipments of air conditioning and commercial refrigeration equipment by class of product for the period 1946 through 1950.

FUEL TRENDS

revealed in Census of Housing report showing year built, equipment, and fuel for dwelling units.

Almost every home had a radio in April 1950, about one out of eight had a television set, and four out of five had mechanical refrigeration, according to preliminary sample data from the 1950 Census of Housing. Utility gas was the predominant cooking fuel and coal ranked first among the fuel used for heating homes. Figures on these and other housing characteristics, based on preliminary sample data from the 1950 Census of Housing, were released in June by Roy V. Peel, Director, Bureau of the Census, Department of Commerce.

• **YEAR BUILT.**—During the last five years, the Nation had one of the greatest building booms in its history. By 1950, units in structures built in 1945 or later amounted to 5.9 million, or 13% of all dwelling units. The volume of building for this period, January 1945 to April 1950, averaged approximately 1.1 million units per year. Nonfarm units accounted for 90% of the new units; the volume of nonfarm housing averaged approximately 1.0 million units per year.

About 3.3 million units were in structures built between 1940 and 1944; thus, there was a total of 9.2 million units, or 21%, in structures less than 10 years old. On the other hand, 20.1 million units, 46% of the total, were in structures more than 30 years old.

• **ELECTRIC LIGHTING.**—About 94% of the total dwelling units had electric lighting in 1950 compared with 79% in 1940. Electric lighting was installed in most of the new units built during the decade; it was also installed in a substantial number of existing units, particularly in the rural areas where power lines had been extended.

Practically all the dwelling units in urban areas had electric lighting. However, in rural areas, electric lighting was lacking in 10% of the rural-nonfarm homes and 22% of the farm homes.

• **REFRIGERATION.**—The number of occupied dwelling units having mechanical refrigeration more than doubled during the past ten years and the number with ice refrigeration was reduced to only half as many as in 1940. In 1950, about 33.5 million occupied dwelling units, or 8 out of 10, reported mechanical refrigeration and 1 out of 10 reported ice refrigeration. The highest proportion of units not having any refrigeration was among rural-farm units, of which 22 per cent lacked refrigeration. In contrast, the proportion lacking refrigeration in urban areas was only 4 percent.

• **COOKING FUEL.**—Utility gas far outranked all other fuels as the principal fuel used for cooking. It was reported as the principal cooking fuel used in 21.4 million units, which was about one-half the occupied dwelling units. Electricity ranked second, with 6.1 million households, or 15%, using it for cooking fuel.

In urban areas, utility gas was first and electricity was second in use. About 70% of the urban units reported utility gas and 12% reported electricity.

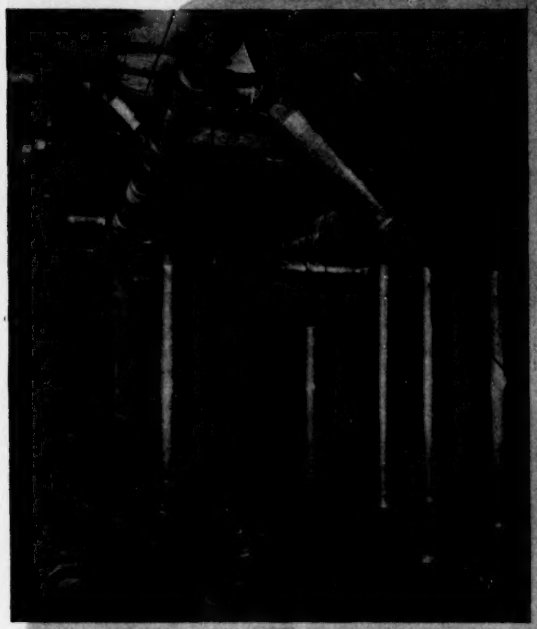
HEATING EQUIPMENT AND HEATING FUEL FOR OCCUPIED DWELLING UNITS, FOR THE UNITED STATES 1950 AND 1940

Subject	1950 Total		1940 Total	
	Number	Per-cent	Number	Per-cent
Occupied dwelling units	42,520,000	.....	34,854,532	.....
HEATING EQUIPMENT				
Number reporting	41,702,000	100.0	34,149,065	100.0
Central heating	20,870,000	50.0	14,346,835	42.0
Piped steam or hot water	9,736,000	23.3	7,427,754	21.8
Warm air furnace	11,134,000	26.7	6,919,081	20.3
Noncentral heating and not heated	20,832,000	50.0	19,802,230	58.0
Noncentral heating	20,118,000	48.2	[1]	[1]
Other means with flue	15,024,000	36.0	[1]	[1]
Other means without flue	5,094,000	12.2	[1]	[1]
Not heated	714,000	1.7	[1]	[1]
HEATING FUEL				
Central heating—Number reporting fuel	20,724,000	100.0	14,152,024	100.0
Coal	9,430,000	45.5	10,903,163	77.0
Wood	250,000	1.2	373,322	2.6
Gas	5,914,000	28.5	1,109,587	7.8
Utility gas	5,719,000	27.6	[1]	[1]
Bottled gas	195,000	0.9	[1]	[1]
Liquid and other fuel	5,130,000	24.8	1,765,952	12.5
Liquid fuel	4,678,000	22.6	[1]	[1]
Other fuel	452,000	2.2	[1]	[1]
Noncentral heating—Number reporting fuel	20,053,000	100.0	19,469,707	100.0
Coal	5,127,000	25.6	7,622,427	39.2
Wood	3,969,000	19.8	7,362,155	37.8
Gas	5,881,000	29.3	2,728,381	14.0
Utility gas	5,204,000	26.0	[1]	[1]
Bottled gas	676,000	3.4	[1]	[1]
Liquid and other fuel	5,077,000	25.3	1,756,744	9.0
Liquid fuel	4,437,000	22.1	[1]	[1]
Electricity	272,000	1.4	[1]	[1]
Other fuel	369,000	1.8	[1]	[1]

[1]Data not available.

(Continued on page 111)

Now, it makes more sense than ever to use...



ONE VITAL SPOT where Revere Copper Tube can be used is in the conveying of liquids in industrial processing. Here is just the place for Revere Copper Tube to show its true worth. For it is non-rusting and will resist the corrosive action encountered in many of the process applications.

UNDERGROUND Revere Copper Water Tube resists the corrosive action of water inside and that of the soil on the outside. It can be bent around obstructions; made to follow the contours of the ground. Its long sections, which may be had in coils, are easier to handle, require fewer fittings.

COPPER WHERE IT COUNTS!

USING Revere Copper in the vital spots has always made common sense. Now, with copper restricted for some uses and limited for others, it becomes even more important to use "Copper Where It Counts!"

Three of these places are: industrial process lines, underground service lines and for domestic hot and cold water lines. Revere Copper Water Tube can be used for these purposes. So, whether you are a contractor, engineer or builder it will pay you to specify and use what copper you *can* get where it will do you and your customers the most good. That means in the spots where rustable materials can't stand the gaff.

Revere Copper Tube is non-rusting, has high corrosion resistance, is easily worked, installation costs are no more than for short-lived materials. It is joined with solder or compression fittings. Revere Copper Tube is ideal for replacement as it is readily bent, requires fewer fittings. It is available in hard and soft tempers, in straight lengths; also in 60′ coils in soft temper. Each length is marked with the name Revere. Look for this mark. It assures uniform quality.

To maintain your reputation for top-quality jobs, while metals remain short, use Revere Copper Water Tube wherever you can. The Revere Technical Advisory Service will be glad to help you in every way possible. Avail yourself of this service through your Revere Distributor. Call him today.

REVERE 150 YEARS OF SERVING AMERICA

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

What supoib taste! For help with the temperature control they consulted Honeywell!

We doubt that cartoonist Larry Reynolds' character, Butch, knows the difference between a stud and a joist.

But he certainly has one mighty sound idea.

Honeywell *can* help heating engineers and contractors provide the proper thermal environment for any client – anywhere – in any kind of structure. We have a lot of well informed control engineers – in our 91 different offices – who are experienced in doing just that. And we have a lot of literature that's yours for the asking – on the automatic control of heating, ventilating and air conditioning.

So, why not *talk to Honeywell?* Why not *write to Honeywell* about *your* control problem? And why not do it *now?*

For information on how to solve heating control problems in hospitals, see the columns on the next two right-hand pages.

MINNEAPOLIS
Honeywell
First in Controls

Among rural-nonfarm units, electricity and utility gas were the chief types of cooking fuel; each was used in about one-fifth of the units.

In rural-farm homes, wood was used most, the proportion being 39%; bottled gas and electricity were next in rank, each being used in 16% of the farm homes.

Although utility gas for home cooking had the greatest number of users in 1950, the number did not increase proportionately as much as the number using electricity since 1940. The number of users of electricity more than tripled in the past decade. The use of wood as the principal cooking fuel decreased substantially.

• **HEATING EQUIPMENT.**—Approximately 20.9 million, or one-half the occupied dwelling units, reported central heating equipment. The proportions with central heating equipment ranged from 62% among urban units to 17% among rural-farm units.

Of the units reporting central heating, about 9.7 million had piped steam or hot water systems and 11.1 million had warm air furnaces. Since 1940, the number of units with warm air furnaces increased much faster than the number with piped steam or hot water. The number of units with warm air furnaces was 6.9 million in 1940 and 11.1 million in 1950; the number with piped steam or hot water increased from 7.4 million to 9.7 million.

The number of units with central heating equipment does not represent the number of central heating installations. The majority of multi-unit structures have only one central heating system which serves all the units in the structure. The number of units with central heating equipment, therefore, is considerably larger than the number of central installations.

The proportion of units with non-central heating equipment was 36% among urban units as compared with 82% among rural-farm units; most of these had flue-connected heating stoves.

• **HEATING FUEL.**—Coal was used for home heating much more extensively than any other fuel. Among the units having central heating equipment, almost half (46%) of the units used coal as the principal fuel; utility gas, which ranked second, was the principal fuel used for heating 28% of the units, while liquid fuel was reported for 23%.

Among the units having non-central heating equipment, coal and utility gas were the fuels used most, each being used as the principal fuel in about one-fourth of the units; liquid fuel and wood were next, each being used in one-fifth of the units.

In the Northeast and North Central Regions, coal was the predominant fuel used for home heating. In both regions, coal was used in approximately one-half the occupied dwelling units.

Utility gas as the principal heating fuel predominated in the West; it was used in almost three-fifths (56%) of the units reporting fuel. In the South, three-tenths of the units used utility gas for heating; coal and wood followed closely, each being used in about one-fourth of the units reporting fuel.

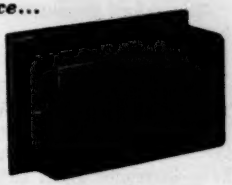
• **RELIABILITY OF THE 1950 DATA.**—Because the 1950 data in this report are based on a sample, the results are subject to sampling variability.

Personalized 8½" x 9" reproductions of this Larry Reynolds cartoon are available upon request.

What supoib taste! For help with the temperature control they consulted (your firm name)

For help with any control problem, talk to Honeywell!

Heating a hospital, for instance...



Here's an excellent way to help make sure the hospital you work on today will meet the demands of tomorrow: *Equip it with Honeywell Individual Room Temperature Controls.*

The trend indicates it will soon be routine medical practice to give each patient the *exact* room temperature he needs to get well fastest. This means, of course, that Individual Room Temperature Control will soon be a "must" in the modern hospital—because no other system can compensate for varying effects of wind, sun, open windows and variations in internal load.

Thus, it's just sound planning to install Honeywell Individual Room Temperature Control when a hospital is being built. Doing it later, as a modernization project, is sure to cost your client substantially more money.

For full facts about this remarkable system—and about the special Honeywell thermostat designed to meet a hospital's special needs—mail the coupon below today.

☐ Please send me complete details on Individual Room Temperature Controls for hospitals.
☐ Send a personalized reproduction of the Reynolds cartoon.

Name_____ Firm Name_____

Address_____ City_____ Zone____ State_____

Sent this coupon today to Dept. HV-9-159, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

First in Controls

• Production of primary aluminum in the United States during the first half of 1951 reached the highest level since the first half of 1944 and exceeded the level for the first half of 1950 by 18%. The total amount produced during the first half of 1951 was 867,181,724 pounds. Aluminum foil shipments during the period totaled 52,753,638 pounds.

• Cathodic protection of tanks, pipes and power cables extends their useful life by five to ten years, report Bureau of Docks (Navy Department) Engineers. This safeguard against galvanic and electrolytic deterioration is maintained artificially by providing DC power at strategic points, with current flowing toward the metal to be protected. High quality magnesium anodes so used have effective life of 10 years. Four corrosion engineering firms are working with the Navy in prolonging life of vital equipment, cutting replacement costs and conserving critical material.

HOUSE HEATING PRACTICE

has changed over the past decade, HHFA survey reveals.

The extent to which practice has changed in house heating during the past decade is reflected in a housing materials use survey made by Housing and Home Finance Agency.

Results of that part of the survey which deals with mechanical equipment are given in the accompanying table. Highlights are that forced warm air systems have increased from 19% of houses built in 1940 to 31% in 1950; forced hot water from 5% to 12%; oil from 13% to 31%; and gas from 13% to 31%.

• **RADIATION.**—The survey also shows that 45% of new radiator heated houses are radiant panel jobs, 42% convectors, and 5% baseboard, the balance of 8% being direct radiators. Since 14% of all new houses are radiator heated (12% forced water, 1% gravity water, 1% steam), then the percent of all single family houses built in 1950 being equipped with convectors is 5.9% (.42 x 14%), by radiant panels 6.3% (.45 x 14%), by conventional radiators 1.1% (0.8 x 14%), and by baseboards 0.7% (.05 x 14%).

Tankless coils and storage type water heaters show important gains since 1940, while side arm heaters declined.

• **SIZE.**—In 1940, 67% of new single-family houses were 1-story, while in 1950 this had increased to 86%. Similarly, new non-basement houses increased from 31% to 61%, one-bathroom house from 80% to 93%, and average area decreased from 1,177 to 983 sq ft.

The survey covers single-family detached houses built during 1940 and those built during the first half of 1950, data being furnished by 50 Federal Housing Administrator field offices. Results were adjusted to cover all detached single-family houses built, regardless of method of financing.

The agency emphasizes that while the sample covered by the survey was adequate, the percentages should be used to indicate trends rather than precise percentage changes.

HEATING AND HOT WATER PRACTICE IN SINGLE-FAMILY HOMES BUILT IN 1940 AND 1950.

Characteristic	Percent of New Houses Equipped	
	1950	1940
Method of Heating Building		
Forced hot water	12	5
Gravity hot water	1	7
Steam	1	9
Forced warm air	18	23
Gravity warm air	31	19
Pipeless furnace	—	1
Floor furnace	22	22
Wall type room heater	6	—
Room heaters, stoves	2	12
Electric heaters	1	—
No heating	6	2
Fuel for Heating		
Oil	31	13
Gas	60	47
Electricity	1	—
Coal or wood	2	38
None	6	2
Method of Heating Service Water		
Storage type heater	67	50
Side arm heater, separate tank	9	35
Coils, separate storage tank	5	1
Tankless coil	10	—
Instantaneous gas heater	—	8
Other	9	6
Cold Water Piping		
Galvanized	53	71
Copper or brass	47	29
Heating System Piping (Radiator Systems Only)†		
Steel or wrought iron	24	92
Copper	76	8
Heating System Ducts (Warm Air Systems Only)‡		
Galvanized steel	87	Not Available
Aluminum	11	
Other	2	
Type of Radiators (Radiator Systems Only)†		
Direct (conventional)	8	Not Available
Convectors	42	
Baseboard	5	
Radiant panel	45	
Material in Plumbing Fixtures		
Bath tubs, cast iron	78	Not Available
Bath tubs, steel	22	
Lavatories, cast iron	73	
Lavatories, steel	15	
Lavatories, other	12	
Kitchen sinks, cast iron	67	
Kitchen sinks, steel	32	
Kitchen sinks, other	1	
Fireplaces		
Yes	78	38
No	22	62

†The percentages in this category are of radiator-heated houses only, not percent of all new houses.
‡The percentages in this category are of warm air-heated houses only, not percent of all new houses.

NEW OIL DISCOVERY

in West Texas may prove biggest in 20 years. Covers ten times area of East Texas pool.

Texas Railroad Commission hearings, held in Austin during July on the vast Sprayberry Trend of oil sand in West Texas, indicated that the area may prove to be the largest discovery in the United States within the last twenty years, or since the discovery of the huge East Texas field.

• **SPREAD.**—The fact that it may cover from 700,000 to 1,000,000 acres was not controverted by witnesses for various interests.

Such a spread of oil territory is almost ten times that of the East Texas field, formerly the largest in the United States. The East Texas field covers 133,000 acres.

There was no attempt at the hearings to show that the Sprayberry Trend has the per acre recovery of the East Texas pool. The only comparison was in size. The East Texas field is eighty-eight miles long and runs from one to ten miles in width.

The Sprayberry Trend, extending through a tier of counties in the midland portion of the Permian Basin, is more than 100 miles long and ten to fifteen miles wide.

Geologically speaking, the witnesses generally agreed, the Trend, a large stratigraphic trap, is continuous.

• **AVAILABLE.**—It also was shown that no other area in this country offered as much additional oil to a ton of steel—drilling and transportation—from a daily production standpoint. Also, it was agreed that there was no other source of supply here where as much oil could be made available in so short a time, and with such a small expenditure of steel.

Given the necessary steel, the Trend can supply a large part of the 1,000,000-barrel daily oil reserve producing capacity desired by the Petroleum Administration for Defense.

The desirability of the oil, which is sweet and of high gravity, is reflected in the rush of pipelines into the area.

Deliverability of the crude oil in case of a national emergency is improved by the fact that two railroads —Texas and Pacific and Santa Fe—have facilities near by for handling tank-car movements.

A-C WATER DEMAND

loads Kansas City supply system to the point of emergency action.

Use of air conditioning in Kansas City, already heavier than in most cities, is increasing so rapidly that eventually such usage will have to be restricted or something will have to be done to supply additional water for air conditioning equipment, according to Melvin P. Hatcher, director of the city water department.

• **ACTION.**—Mr. Hatcher disclosed (July 28) that his department is considering construction of another pumping station adjacent to the downtown district to take care of the air conditioning demands on the sys-

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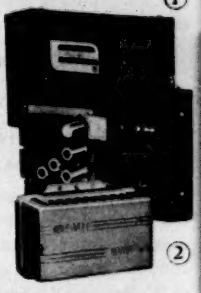
What supoib taste! For help with the temperature control they consulted (your firm name)

For help with any control problem, talk to Honeywell!

Air conditioning, for instance...



By applying electronics to air conditioning control, Honeywell has produced a system that's years ahead in design!

It's the world's most sensitive air conditioning control—responds instantly to temperature change—no waste of warm or cool air. And it's much simpler—servicing is practically eliminated.

In addition to the electronic relay 1) and space thermostat 2), the system incorporates duct thermostats, immersion thermostats, and motorized valves and dampers.

This system costs less to operate, too—because only when outside air is too warm to use for cooling does the system call for refrigeration.

So whenever you're planning temperature control for hospitals, stores, offices, restaurants, theatres or any other kind of structure, be sure to call for Honeywell Electronic Air Conditioning Control.

☐ Please send complete information on Honeywell Electronic Air Conditioning Control.
☐ Send a personalized reproduction of the Reynolds cartoon.

Name _____ Firm Name _____

Address _____ City _____ Zone _____ State _____

Send this coupon today to Dept. HV-9-159, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

First in Controls

tem. Pointing out that Kansas City now is using about 20,000,000 gallons of water a day on hot days for air conditioning alone, with most of this in the downtown area, Hatcher said that if this demand should double, as trends indicate it may, more water will have to be pumped into the downtown district.

Although that could be done by installing additional mains from the city's Turkey Creek pumping station, he said it was believed a better idea to build another pumping station for use only in hot weather when air condition demand is high.

• **FIGURES.**—Data on air conditioning assembled by the Kansas City Power & Light Co. disclose that Kansas City has 93 tons of refrigeration for each 1,000 population, compared to only 50 tons per 1,000 in most cities as Philadelphia and Chicago. A number of other cities already have had to limit the amount of water used for air conditioning. Figures of the utility company show there are 42,000 tons of refrigeration for air conditioning in Kansas City.

Mr. Hatcher said his department engineers are gathering data which will be turned over to consulting engineering firms for determination of the impact on the distribution system of the increase in installation of new air conditioning units.

AGA CONVENTION

to examine technical, political, and financial problems of gas industry in $4.5 billion expansion.

Natural gas expansion, utility financing, public relations, and federal controls will head the list of important subjects to be covered at the thirty-third annual convention of the American Gas Association at St. Louis, Missouri, October 15 to 17 inclusive.

More than 5,000 delegates are expected for the meeting. The roster of speakers will be headed by Senator Everett M. Dirksen, of Illinois, and Frank C. Cortright, executive vice president, National Association of Home Builders. The General Convention Committee is under the chairmanship of Robert W. Otto, president, Laclede Gas Co.

D. A. Hulcy, of Dallas, Texas, who is president of both the AGA and the U. S. Chamber of Commerce, is slated to open the convention on Monday morning, October 15, with an address on the prospects and accomplishments of the gas industry. Mr. Hulcy is also president of the Lone Star Gas Co. in Dallas.

The close relationship between gas utilities and appliance manufacturers will be spotlighted by Frederic O. Hess, president, Gas Appliance Manufacturers Association and president, Selas Corp., Philadelphia, in another Monday morning feature. This meeting and most of the convention sessions will be held in the Kiel Auditorium.

America's gas utilities have launched a four and a half billion dollar expansion program, which will require $3.2 billion in new financing over the next five years. For a viewpoint on the attitude of large financial institutions on this program, the Monday general session will hear from a distinguished financial speaker, well known in banking circles.

Federal controls and credit regulations have restricted construction of new homes in 1951, and next year's picture is uncertain. Mr. Cortright, as head of the organized home-building industry and a leading authority in residential construction, will report on the outlook for housing in 1952, at Tuesday's general session. Harry K. Wrench, president, Milwaukee Gas Co., will discuss the importance of natural gas in economic development of gas utilities and the nation.

Mr. Hulcy will present awards at the general session on Tuesday for outstanding achievements by gas industry members in the past year. The awards include the AGA Distinguished Service Award for the most outstanding contribution to the advancement of the industry; the Beal Medal for the best technical paper presented during the year; the McCarter Medal for successful resuscitations from asphyxiation by gas; and the McCall Awards for exceptional achievements in home service work.

Other sessions and events will cover problems in natural and manufactured gas utilization, public relations, appliance design and sales, utility operation, industrial and home service.

RIVER COAL

plays diminishing role in supply of small anthracite sizes for power generators.

Ever since the beginning of anthracite mining a century and a quarter ago until about three or four years back, breaker waste and quantities of the very small sizes, including silt, were allowed to be carried down streams flowing through the producing region and finally into the rivers. There is no estimate of the quantity of recoverable coal remaining in the river beds, although the Bureau of Mines estimates that a total of 28.5 million tons was dredged between the years 1909 and 1949.

• **DECLINE.**—During the latest ten years of record, 1940-1949 inclusive, shipments of river, or dredge, coal averaged 1,181,000 tons annually. Over 76% was reclaimed from the Susquehanna River, mostly below Sunbury, and 96% originated in the Schuylkill Region. The river coal industry employed an average of 445 men during these years, and operated an average of 233 days per year. Production per man per day averaged 11.4 tons in this period. The all-time peak of shipments of 1,515,000 tons was reached in 1941. In 1949, 76% of the recovery was in sizes smaller than barley, and barley itself constituted an additional 22%.

Since peak production of 1.5 million tons in 1941, however, dredge production has displayed a generally declining tendency to 0.9 million tons in 1949, and has contributed diminishing proportions of the total available supply of barley and smaller sizes with which they compete. This proportion has diminished from 17.3% in 1941 to 9.3% in 1949.

The figures are particularly interesting to public utility electric generating companies, large manufacturing plants and others which are equipped with specially designed combustion units to burn the very

(Concluded on page 124)

Only 7 lbs. pressure provides FINE, UNIFORM BREAK-UP AND DISTRIBUTION OF FLUID

with **Binks** ROTOJET clog-proof spray nozzles

Absence of internal vanes and obstructions permits maximum spraying efficiency at extremely low pressures with Binks Rotojet Spray Nozzles. Designed on the off-center inlet, whirl chamber principle for greatest spraying effectiveness. Sizes up to ¾" pipe connection are of two-piece construction, precision-machined from finest quality brass bar stock, stainless steel or any special alloy that is machinable from bar stock. Sizes from 1" to 2½" have strong cast one-piece bodies. Wide capacity range.

Send today for technical bulletin describing Binks ROTOJET Nozzles

Bulletins give full information on sizes and capacities of the following Binks Rotojet Nozzles:
Bulletin Numbers:

10. Small and Medium Capacity Nozzles
11. Nozzles for Brine Spray Operation
12. Large Capacity Nozzles
13. Nozzles for Spray Ponds
14. Nozzles for Metal Cleaning Operations.

Please state how nozzles will be used, giving installation capacity.

THERE'S A BINKS SPRAY NOZZLE FOR EVERY SPRAY JOB

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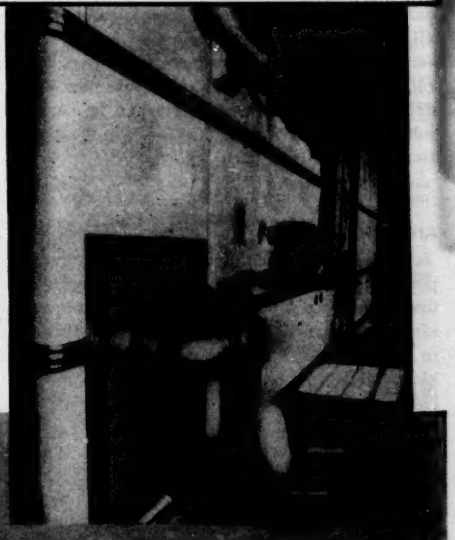
Bryant Industrial **POW·R·SEMBLIES**

Pre-engineered Packages for Controlled Gas Combustion

For firing air heaters, kilns, boilers and other appliances including ovens (shown here).

The Bryant Pow-R-Sembly is supplied in various arrangements of accessories to provide completely automatic, semi-automatic or manual operation. Capacities from 400,000 to 10,000,000 Btu per hour.

The Pow-R-Sembly can be adjusted for any type flame. Once set by simple, quick adjustment, it maintains constant flame characteristics. It is smooth-running and burns any low-pressure gas. Flanged connections permit arrangement in any desired position without extra equipment. Send for Data Sheet 7C-1a for complete information.



BRYANT INDUSTRIAL DIVISION
Affiliated Gas Equipment, Inc.
17825 ST. CLAIR AVENUE · CLEVELAND 10, OHIO

Experience is my Classroom

By T. W. REYNOLDS

EDITOR'S NOTE. Mr. Reynolds continues the subject of servicing, trouble jobs, maintenance and similar problems.

THE PACKAGE UNIT

I did not start out with the package unit in mind, nor do I plan to end up on that subject, but my own discussions and years of trouble experience bring me to the realization that something should be done about these costly and time-delaying, but commonly accepted service troubles and the various other troubles designated as job conditions. None of us can stop these trends of poor workmanship and indifference, but old wise men, or better still the younger men who have accepted these things will no doubt find some way around these difficulties.

And so, as I write on, it dawns on me that I have been making out a good case for the package unit. Why not put everything in one bundle? It seems to be a growing trend. Package water tube boilers have been recently added to the list of packaged units of various kind. They fill the present need for completely shop assembled steam generating units in moderate capacities. They come assembled with brickwork, insulation, trim, burner and soot and forced draft blowers, together with all required certificates. The only field work on the units is their skidding or lifting into position and the making of the usual service connections by local labor. The more complicated a system becomes, the more packaging it needs.

A package unit of any kind has the advantage of ease in relocating, higher resale value and, most of all, the undivided responsibility for its complete assembly. It is easy to remove some part of a unit for return to the factory and substitute new parts without delay, or the component parts can be serviced on the job by men who specialize on service for that particular unit.

AIR CONDITIONING

Conference rooms have no heat gain from lights and population until used, so that they are overcooled when first opened up for a conference. The overcooled return air was returned, in one case I recall, through louvers in the doors and then passed the desk of the boss in his adjacent private office. He was so overcooled that he made it hot for everyone that had anything to do with the project.

In a store there are recirculation grilles in partitions separating the main store conditioned area from the unconditioned stock and service area which also contains the air conditioning units. Someone hangs a rug for display on the partition and the air then finds it easier to return to the units by way of an opened door to the service area.

Even without the rug over the recirculation grilles, the air will prefer the open door, and flow over a girl at a desk. So she becomes overcooled, although she is soon made happy by moving her desk and providing it with a glass deflecting shield. There are two air conditioning units where she sits, one of which is to be run in cooler weather, or whenever service is required on either. Unfortunately, you find them wired together for both to run on the same control. Then, along comes the service man and both are stopped. As a result the girl becomes too hot and again unhappy.

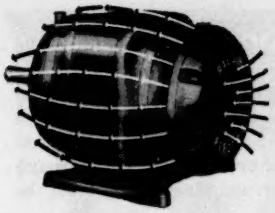
Out in the main store area a control thermostat finds hot company in the way of a large display light someone has just installed, or the control becomes blocked by some store fixtures where it can neither be read, adjusted and serviced; nor can it properly control, due to lack of representative environment. In either case, everyone becomes overcooled.

In one case, the controls, during construction, were temporarily stored outdoors. A hurricane came along and corroded all of the control contacts, so that for a time after their installation, there was no control of any kind. When some of these are cleaned and others replaced, you find time to examine the two air compressors for the controls. These are vibrating and otherwise acting up. They do have sufficient air capacity for all of the ordinary controls, but not enough for operation of the suction damper on the big centrifugal refrigerating compressor. This damper alone requires 5 cfm and was so specified. So larger compressors are ordered to run only the usual 25% at the time, instead of those now running continuously, and even then never catching up with requirements.

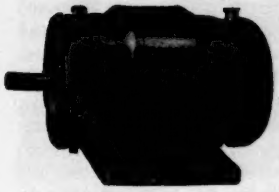
Next you examine the areas around presses in a tailor shop, as these are reported hot due to steam vapors. It is then decided that the presses be provided with vacuum valves relieving steam to above the roof and all is well again.

Such happiness is short lived, for shortly you find an air conditioning unit has stopped because some single individual, perhaps an underclothed female with poor circulation, has learned where the switch is that stops the unit. The manager grudgingly accepts your explanation, but leaves you with the impression that you are in the wrong. It is obvious that this lady is an exception, should be given a job to make her active and occasionally leave her desk, should wear more clothing, see a doctor, or be fired; but most of all you should in the future install the switches back of locked doors.

Some other lady learns how to throttle the air out-



Baldor
dependable MOTORS



extra features at no extra cost

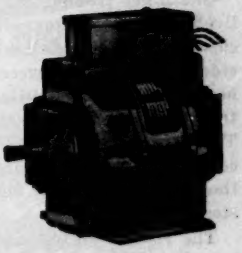
Totally enclosed . . . ball-bearing.

Externally ventilated, fan-cooled, non-clogging. Dust-proof, splash-proof, lint-proof.

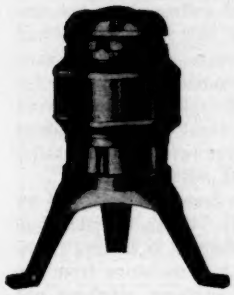
Standard NEMA dimensions.

Corrosion-resistant . . . inside and out. Specially impregnated to resist moisture.

Standard and face mounted end-plates, interchangeable for vertical or bracket type motors.



BALDOR Motors are original equipment on many nationally advertised, nationally accepted pumps, blowers, furnace fans, unit heaters, compressors and oil and gas heating equipment.



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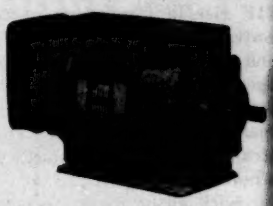
★ *BALDOR Motors are sold and serviced in more than 300 Trade Centers.*



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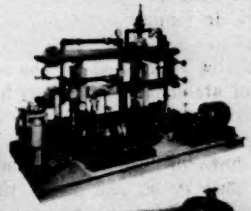
Paracoil Vertical Type Tank Section Heater. (For Buried Tank Installations.)

- PARACOIL has been part and parcel of the oil burner industry from its inception . . . and is intimately acquainted with its needs!
- PARACOIL builds every size and type of fuel oil heater used in the industry . . . with capacities to 3000 GPM or more . . . for [illegible] without limitation!
- PARACOIL [illegible] rated. Maximum heat transfer . . . low pressure losses . . . long operating life at top output . . . and freedom from service shut-[illegible]
- PARACOIL prices are right. Mass production of standardized models is the answer. Heavy [illegible]



Paracoil Fuel Oil Heaters on Pump Set Assemblies. Our Tubular and Straight Tube Types are used by all leading pump set fabricators.

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let over her head which then makes a gentleman nearby unhappy, because more air now comes out of an outlet over his head. Since you have learned that drafts are not always from the near outlet, but rather from some distant outlet, you find by smoke test a remote outlet deflecting its air to and along a partition to the first troubled area. Baffling of this distant outlet stops the draft, but still you have a hard time convincing the first individual that it is now all right to open wide her overhead outlet.

One other trouble from drafts is too much air delivered to an area surrounded by hot partitions which close off unimportant unconditioned passages or small storage spaces. The excess air to compensate for large heat gains of hot partitions could well be delivered on the other side of these then no longer hot partitions. This would lessen the air movement in the regular conditioned area and also provide some cooling for those who occasionally enter either the passage or the stock areas.

The rise in chilled water temperature is found to be only 4F through some air conditioning units, with 21F rise in some other units. Valves on all chilled water lines are then balanced for equal flow to all units and after closing by-pass valves which someone had opened for easier control in balancing, conditions are bettered, although only slightly so. Then, the main reason is found. It's the unbalanced flow due to some strainers at units practically plugged with dirt, while others are only partially so. But we are not through, for with all of these strainers cleaned out, the temperature of air at outlets is changed and becomes unsatisfactory. Each air supply outlet and each thermostat that someone has tampered with in an effort to get cool, must then be readjusted for the new conditions. Balancing of air delivery at outlets had been done too soon.

Someone suggests that the chilled water system be occasionally drawn down to flush the dirt instead of cleaning strainers. They do so, and find it time consuming, with some pipes left air bound upon refilling of the system. Someone else suggests more strainers. They do this, and find the situation over-strained.

Doors supposed to act as louvers for return of air are not all louvered. A store escalator, depended upon for relief of air from top story to ground floor, is not installed because at the last moment it is decided not to build the escalator for a year or two. Someone complains of odors and you find all of the outdoor dampers to units practically closed. Some who go to the toilets think they smell odors and open the toilet windows. This short-circuits hot air from outdoors to the toilet exhaust fan, or else gives too much relief of air, even as it does for a girl next to a window she has opened in the working area. She says she gets more relief that way, and she does, because the air all relieves past her. The near supply outlets then get more air and this short-circuits to her opened window. No one else gets relief but she.

Over in some other area there is some complaints of odors. You do find odors and they are from sewage. You do some thinking and then recall that down in the basement is a municipal sewage pump confined in a small area entered only from outdoors. Smoke released in this pump room soon finds its way up to the odorized area. It gets there by way of some unpacked sleeves around chilled water pipes which enter and leave the sewage room and then go as risers to upper floors. In another case you find a machinery penthouse nicely air conditioned by cool air flowing through a lot of unpacked sleeves around pipe coming from the conditioned floor below.

Throwaway conditioned air in one case was supposed to relieve itself through louvers in toilet doors and opened windows in the toilets to the great outdoors. The outdoors at this point was but one story above a gasoline odorized driveway, and on the windward side, so that gasoline odors combined with toilet odors came back through door louvers to the conditioned area. This condition was aggravated due to an afterthought by the management in the way of a small coffee drinking area. To free the area of coffee odors, the employees opened the windows at this coffee center and thereby relieved the air pressure on this lee side, leaving no pressure in the conditioning system for the toilet area. This method, together with wind pressure at the toilet windows, resulted in a nice short circuit for odors from the windward gasoline toilet odorized side to leeward exit at coffee odor side.

Water drips on merchandise from some part of an overhead air conditioning unit. There is much hue and cry. No one knows just where it is coming from. It is simple, though, for it is just moisture from air collecting on cold uninsulated surfaces, surfaces not supposed to be cold, such as a bare nipple and cap from a strainer. These get cold by conduction from chilled water piping. A drain pipe from an air conditioning unit should also be insulated up to and including its drain valve.

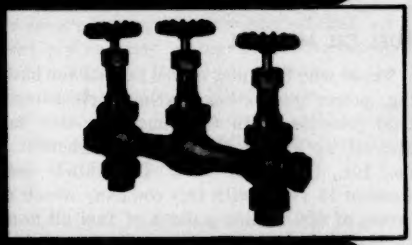
BOILERS AND CHIMNEYS

Boilers may have insufficient draft, because there is no adequate air inlet to the boiler room. If the uptake section of a boiler is assembled near the front of the boiler, hot gases will by-pass most of the heat absorbing surfaces, so that the boiler may not even steam. A boiler being assembled in the factory may have a bar of soap stored within it for use in employees washing up. It may drop down inside a boiler section, or be forgotten. This can cause a boiler to foam and give a lot of trouble when the boiler is finally set up on the job.

When the chimney has so large an area that downdrafts prevail within it, one can easily remedy this condition by closing off some of the chimney exit area above the roof. If there is trouble from smoke at the fireplace, it usually comes about from air short-circuiting above the fire to crowd the chimney area, thus excluding the smoke from combustion. In such a case, the height of fireplace opening should be reduced, either by building up its hearth or building down the top of the fireplace opening.

(The question of servicing will be continued in this department in a subsequent issue.)

The Compactness of
HONEYWELL BY-PASSES



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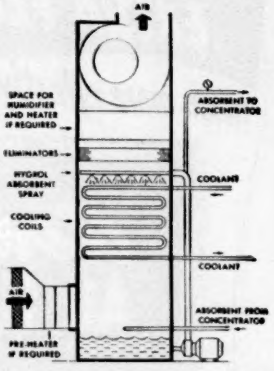

NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.

The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"— a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously reconcentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.

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Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available.

For further information, write to Niagara Blower Company, Dept. HV, 405 Lexington Ave., New York 17, N. Y.

ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

FUEL OIL MANUAL

Those who buy, use, or sell fuel oil for building heating, power generation, marine applications or industrial processes, will find much of value in Fuel Oil Manual, by Paul F. Schmidt, chief chemist, Allied Oil Co., Inc., Cleveland, Ohio. The author has been associated 15 years with this company which markets in excess of 500 million gallons of fuel oil annually, and he is in charge of testing all oils received and in blending oils for special specifications. The book is the result of years of experience in trouble shooting.

Technical language is used as little as possible, and theory and involved discussions of interest only to chemists or refiners are avoided. All terms are fully explained.

Covered in this book are complete data on the properties of fuel oil, the possibilities and limitations of each grade of oil, methods which can be used to assure uniform quality and efficient combustion, how to diagnose fuel oil troubles and how to remedy them, and particularly important, how to get maximum value from each fuel oil dollar. Under Troubles and Remedies are listed 22 of the common fuel oil troubles, their symptoms, and the remedy to follow in each case.

The text, which includes 34 tables, is divided into 24 chapters covering chemistry of petroleum, petroleum refining processes, grades and types of fuel oils, gravity, heat of combustion, viscosity, water and sediment, carbon, ash and salt residue, flash and fire points, pour point, sulfur, color, distillation, preheating of oils, sampling storage tanks, stability of fuel oils, fuel oil treatments, reclaimed fuel oils, blending of oils, transportation and storage, fuel oil specifications, and complaints and causes of troubles.

The tables present concise, easy-to-follow data that should prove of exceptional interest to the engineer or technical man.

Fuel Oil Manual, by P. F. Schmidt. Flexible Fabrikoid binding, 6 x 9 inches, 160 pages. Published by The Industrial Press, 148 Lafayette Street, New York 13, N. Y. Price, $3.50. Canadian or foreign postage, 40 cents.

INDUSTRIAL PIPING

Of interest to the piping engineer concerned with process industries, petroleum industries and power plants, is the new book on Industrial Piping, by Charles T. Littleton, formerly engineer in charge of piping, American Cyanimid Co. It also has a chapter on estimating, prepared by R. A. Dickson of the Standard Oil Co. of New Jersey, based on articles published in *Chemical Engineering*.

The book is intended to present in one volume, the information now available from such scattered sources as data sheets, catalogs and standard specifications. There is material on water, gas, steam and other

services, and on the most recenty developed piping materials, alloys and plastics. An entire chapter is devoted to flow sheets, plot plans and design procedure. Tables of fittings have been grouped according to their most general use—water, steam, or other service.

The author covers valves, steam, water, oil, gas, air and instrument piping, alloy piping, and other piping materials, and insulation. In addition, there is the previously mentioned chapter by Mr. Dickson.

Industrial Piping, by C. T. Littleton. Cloth bound, 6 x 9 inches, 394 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $8.

LESSONS IN ARC WELDING

Basic fundamentals of arc welding, as well as more advanced welding technique, are covered in New Lessons in Arc Welding based on lessons and instructions given at the Lincoln Arc Welding School. There are 32 basic lessons covering welding mild steel in all positions and 29 advanced lessons on other welding applications.

Covered in this concise, practical book are latest welding procedures for faster and lowest cost welding, automatic and semi-automatic hidden arc welding procedure, how metals are made and how to identify them, how to select correct welding joints, how to make common machine parts to use welding instead of casting.

This book is well illustrated and, as an aid to the student, there are questions and answers based on the various lessons.

New Lessons in Arc Welding. Bound in simulated leather, 6 x 9 inches, 320 pages. Published by The Lincoln Electric Co., Cleveland 17, Ohio. Price, $1.

MINERAL WOOL INSULATION

A practical insulation handbook, Mineral Wool Insulation Specifications and Standards, to serve as a guide in properly selecting materials and application practices for government contracts, and to serve as a basis for specifications in industry, has been issued by the Industrial Mineral Wool Institute. It includes 21 specifications and standards by four government agencies and the American Society for Testing Materials. Seven of the standards approved by governmental agencies are Federal Specifications approved by the Director of Procurement for use of all government departments, three are specifications by the Navy Department and two by the U. S. Maritime Commission. There are three commercial standards issued by the National Bureau of Standards.

The ASTM specifications cover six types of industrial mineral wool insulation — mineral wool cement, batt, blanket, felt and blanket-type and molded-type pipe insulation.

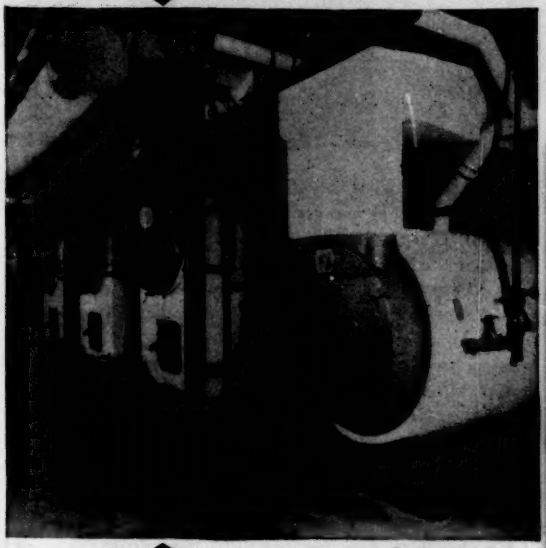
The book has protruding tabs to help locate material on federal, Navy, maritime, and ASTM specifications, and commercial standards.

Mineral Wool Insulation Specifications and Stand-

For "Bedrock Economy" in HEATING and POWER

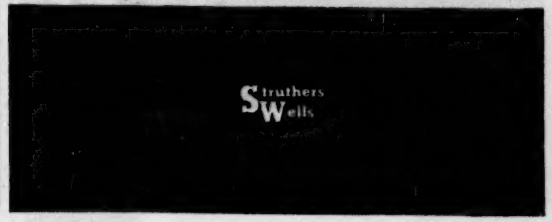
Choose and use

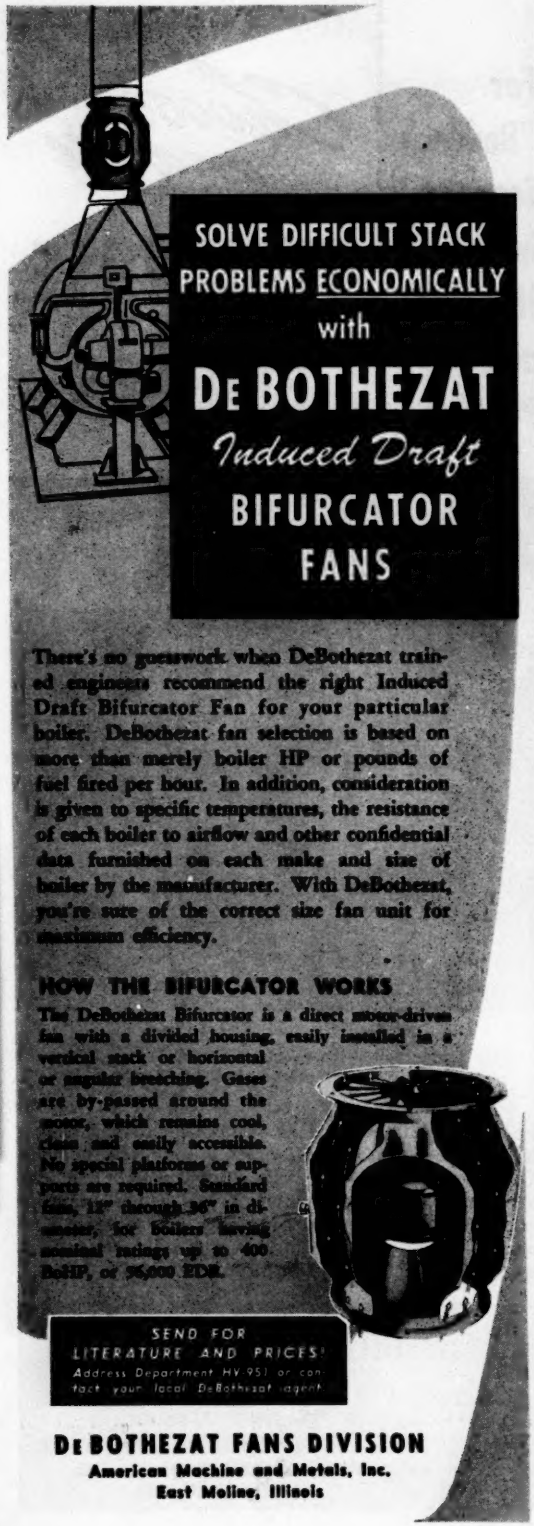
TITUSVILLE BOILERS



Compact, efficient layout distinguishes this Titusville boiler installation.

Here in the boiler room of the new Booker T. Washington High School in Shreveport, La., are shown three Titusville "Compact" Steel Heating Boilers (total rated capacity in excess of 36,000 sq. ft.), with a 30 H.P. Titusville "Wee Scot" marine boiler serving laundry and kitchen. The complete range of Titusville boilers enables many ideal service combinations. *Write us for details.*

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REDUCING DUST EMISSION—Forty-seven tests were made on a continuous ash discharge spreader-stoker-fired boiler to determine means of reducing dust emission. In addition to baring rate, variables investigated were the amount of overfire air, the use of air steam and steam air jets, the location of steam jets, the degree of reinjection used and the coal size. Results of these studies are presented in paper No. 51-SA-20 titled "Methods of Reducing Dust Emission From a Spreader-Stoker-Fired Boiler Furnace." Bituminous Coal Research, Inc., 2609 First National Bank Bldg., Pittsburgh 22, Pa. Price, 20 cents.

CHARACTERISTICS OF PACKAGED FUELS—The Bureau of Mines has investigated combustion characteristics and physical properties of six different lots of packaged fuels made from bituminous coal. All of the fuels tested were prepared by a commercial process and all contained 4% asphaltic binder. The relative suitability for domestic use of the six lots tested was evaluated upon the basis of the characteristics. Findings are contained in Report of Investigations 4797. Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

NATURAL VENTILATION OF BUILDINGS—A comprehensive research report (No. 22) has been released by The Texas Engineering Experiment Station on Some General Considerations in the Natural Ventilation of Buildings. This report, which is a primer, supplies an introduction into problems which are involved with the design of buildings and presents some simple basic facts on the movement of air. The problem of air movement has always been an important one in the southwest and is essential for comfort during the hot months. This report was prepared by an architect, an aeronautical engineer and a physicist. In this way, it was possible to obtain broad interpretations of the natural ventilation problems. Report No. 22 is the first of a series planned on designing buildings to facilitate ventilation by natural means. Texas Engineering Experiment Station, College Station, Texas.

SMA STATISTICAL REPORT — The fourth edition of SMA statistical report on fuel burning equipment installations in various cities for year 1950 has been released by the Stoker Manufacturers Association. It is factual in preparation and an attempt was made to include interpretative data or comments. It presents data on installations in many American cities and a few Canadian cities. Stoker Manufacturers Association, 307 North Michigan Ave., Chicago 1, Ill.

TEMPORARY VENTILATION OF THE KING SOLOMON TUNNEL—Temporary ventilation methods and safety measures used in the King Solomon Tunnel, Frisco, Colo., are contained in the Bureau of Mines Information Circular 7603. The mine had been idle since 1915 and at the time of the study was accessible to only about 700 feet from the portal of the adit because of oxygen deficient air. Actual ventilation for this tunnel was completed on September 20, 1950. The circular describes the method of ventilation used and presents a log of operations. U. S. Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

I-B-R INSTALLATION GUIDE No. 6—Data are presented in this 19-page booklet for use in designing floor and ceiling panel heating systems for small residences. It is based on conservative averages of information found in manufacturers' and industry literature. The step-by-step design procedure should be easy to follow. Included are tables for use in making calculations. The Institute of Boiler and Radiator Manufacturers, 60 East 42nd St., New York 17, N. Y. Price, 50 cents.

MODELS FOR PREDETERMINING NATURAL VENTILATION —In milder climates, the advantages of using the natural wind to ventilate buildings has long been recognized. However, little work has been done to establish methods for predetermining the natural air flow patterns for ventilating proposed buildings. Results of an investigation into this subject are contained in Research Report No. 26 on The Feasibility of Using Models for Predetermining Natural Ventilation. Report of 25 pages covers interior and exterior air flow patterns, and methods by which air flow patterns can be made visible. Texas Engineering Experiment Station, College Station, Texas.

STANDARDS OF HEAT EXCHANGE INSTITUTE — The third edition of Standards of Heat Exchange Institute is now available. This 23-page paper-bound book covers nomenclature, definitions and standards for condenser performance and also information required in the calculation of water requirements. Other points covered are vacuum pump capacity, installation, information on atmospheric relief valves, and a series of conversion tables useful in calculation and installation of this type of jet condenser. Heat Exchange Institute, 122 East 42nd St., New York 17, N. Y. Price, $1.

INSPECTION OF FINE-PITCH GEARS—The American Society of Mechanical Engineers, in conjunction with the American Gear Manufacturers Association, are responsible for a new American Standard covering inspection of fine-pitch gears. This standard has been made flexible to meet the requirements of the greatly diverse applications of fine-pitch gears. It does not cover tolerances on center distances and accuracy required in mountings. American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. Price, $2.50.

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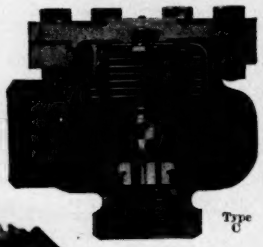

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Based on the hot thermopile principle, the AGITAIR Meter gives instantaneous accurate measurements of air velocities as low as 5 fpm, and as high as 4000 fpm. It is inherently stable, does not waver or jerk and unlike many resistance type hot-wire instruments it is free from errors caused by temperature variations, radiation effects and lead resistance. For taking static pressure readings from 0 to 4" wg, a special attachment is provided. The simplicity and utility of the AGITAIR Meter make it useful for many diverse applications.

Write for Bulletin AM-100

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Air Dryers • Air Filters • Enhancers

River Coal

(Continued from page 114)

small sizes, and which look to this industry for their future supplies.

• **NO DUMPING.**—With the new markets being created, anthracite producers are retaining in flotation plants and otherwise the very small sizes and silt which were formerly discarded, with the result that at present and in the future, increasing quantities should be available from the producing industry and less from dredge operations. This will be beneficial to purchasers, as they will be assured of better preparation and more dependable sources of supply.

Trap Inventor Honored

• John F. McKee of Ardmore, Pennsylvania, has been awarded a Certificate of Merit by The Franklin Institute for his development of a small, lightweight steam trap which is factory adjusted to meet a wide range of conditions and pressures, it was announced by Dr. Henry B. Allen, executive vice president and secretary of the Institute. Mr. McKee, a research engineer affiliated with the Yarnall-Waring Co. in Philadelphia, designed a steam trap which makes use of the flow characteristics of two orifices arranged in series by using the variation in pressure which occurs in an intermediate chamber located between the two orifices to control the discharge valve. The intermediate pressure existing between the two orifices depends upon the nature and properties, particularly the temperature and phase, of the fluid flowing. Thus, if cold water or relatively low temperature condensate is supplied to the inlet, the control chamber pressure will be relatively low, and the excess pressure acting under the control valve disc will cause the valve to open and permit discharge of condensate through the main valve. If relatively hot condensate or steam is applied to the inlet, a relatively high control chamber pressure will be established and this pressure acting on top of the valve disc will keep the valve closed. The water temperature at which the valve will operate may be controlled by practical features of design. This steam trap is manufactured by the Yarnall-Waring Co., under the name of the Yarway Impulse Steam Trap.

• The annual instruction courses for operating and maintenance engineers under auspices of Bahnson Co., Winston-Salem, N. C., air conditioning engineers and manufacturers, will be held in two one-week sessions at the Robert E. Lee Hotel in Winston-Salem, October 1 to 5 and October 15 to 19. Instructor-engineers from Bahnson and component suppliers will speak on operation and maintenance of various items of refrigeration and air conditioning equipment, with emphasis on those used in the textile and tobacco industries. Classes the first week will cover primarily evaporative cooling, while the second will cover refrigeration.

• Cleaner Air Week will be observed in the United States and Canada from October 21 to 27. This announcement was made by Charles N. Howison, National Chairman of the Cleaner Air Week committee of the Air Pollution and Smoke Prevention Association of America, and secretary of the Smoke Abatement League of Hamilton County, Cincinnati, Ohio, in conjunction with the United States Department of Commerce.

• A formal opening in October has been scheduled by The National Radiator Co., Johnstown, Pa., of its new one- and one-quarter million dollar plant at Duncansville, Pa. The steel fabricating plant in Danville, Pa., which The National Radiator Co. purchased in December, 1950, was sold on August 10 to Thompson Products, Inc. of Cleveland.

• F. A. Hopp, formerly associated with the Delta Power Division of Rockwell Manufacturing Co., has been appointed advertising manager of the Cleaver-Brooks Co. A native of Whitefish Bay, Mr. Hopp attended the University of Wisconsin and Marquette. He is a member of the Milwaukee Industrial Marketing Association.

• Construction contracts awarded in the 37 states east of the Rockies for the first seven months of 1951 set a new high for that period with a total of $10.2 billion, it was stated by F. W. Dodge Corp. This was 23% greater than 1950's total, up to this year the highest seven months on record. Non-residential contracts were 65% greater; residential awards were down 2%; public and private works and utilities were up 10% over 1950.

AIR CONDITIONING DESIGN DATA FOR FOOD INDUSTRIES

(Continued from page 84)

Meat and Meat Products

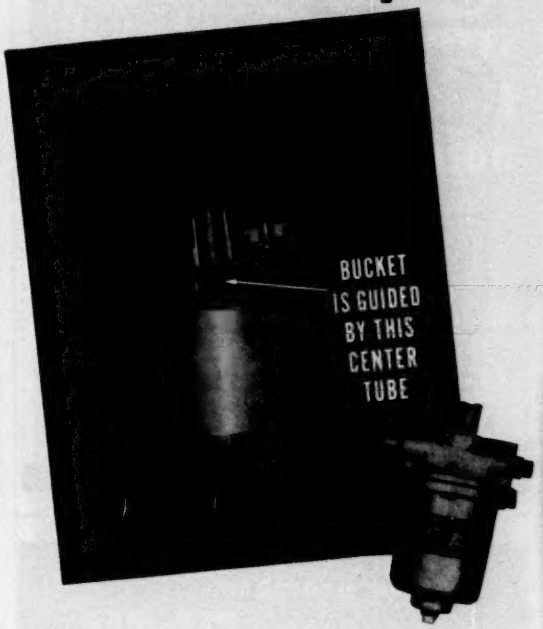
Aside from the information given in Table 3, which is a tabulation for an entire industry, one meat packer has found the conditions listed in Table 2 satisfactory for their processing and packaging departments.

During hog chilling, while the final cooler temperature is 28F and the minimum relative humidity is 85%, the relative humidity is much higher during the first part of the cooling cycle. Throughout the cooler, there are from one to 1.5 air changes per minute.

Aside from the areas listed in Table 2, satisfactory humidities are maintained to avoid excessive dryness. However, reheat is necessary to provide air of low humidity and comfort for employes in the wrapping rooms and in the dry sausage drying rooms.

Air conditioning is necessary for a wide variety of processes and products in meat packing plants. Each type of meat requires special air conditions. Table 3 lists the suggested air conditions for various processes and rooms in meat packing plants.

HOW the exclusive SUPER-SILVERTOP GUIDED BUCKET *Saves Money*



The exclusive Super-Silvertop guided bucket saves money by preventing damage to the bucket. A patented guided tube positively controls the bucket, eliminating the possibility of any bucket swing which might impair the bucket and lead to high replacement cost. But this is only one reason why Super-Silvertops cost *less* in operation than any other trap. In addition, the engineered Super-Silvertop bucket lever assures positive seating . . . preventing costly leakage of live steam. Furthermore, these money-saving traps can be installed in a minimum of time, straight in line or as an elbow and can be serviced without disturbing a single fitting. It pays to standardize on Super-Silvertops. Talk it over with your nearest authorized Super-Silvertop representative or write us for a copy of "Solving Steam Trap Problems."

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WHAT WOULD YOU DO?

(Continued from page 98)

The following points should be carefully followed:

Rubber lined pipe and fittings should be handled carefully. The joints should be bolted until they are leakproof and the proper gaskets should be used.

For maximum service life, the operating temperature should not exceed 180F.

The outside of the pipe and fitting should be watched periodically for possible leakage. Any sign of leakage should be investigated immediately and the necessary steps taken to prevent further damage.

All rubber lined equipment that is shipped by this company has the following brief instructions that maximum service life may be obtained.

Use only in the service for which the lining is furnished.

Avoid exposing the lining to sudden temperature changes, physical shock or rough handling.

Do not weld or heat the metal wall above the recommended process temperature.

Make periodic inspections of the lining.

Use the proper gaskets when assembling the equipment. Align joints carefully and tighten bolts evenly.

If the equipment is to remain out of service for an extended period of time, store indoors in a moderate temperature, if at all possible. If necessary to store out-of-doors, protect equipment from direct sunlight and keep it filled with a weak acid or alkaline solution.

E. L. Lockman, Manager
Tank Lining and Roll Covering Sales,
United States Rubber Co.

Providence, R. I.

WHAT READERS SAY

Air Conditioned Ships

THE EDITOR, HEATING AND VENTILATING:

We were particularly interested to notice in the August issue of HEATING AND VENTILATING, under the column headed Briefly Stated, you report that the Carrier Corporation of Syracuse, N. Y., claim to have installed the air conditioning plant in the first wholly air conditioned ship built in a foreign country since the end of World War II.

We feel that on behalf of our parent organization, Messrs. Thermotank, Ltd., Glasgow, Scotland, we cannot aliow this statement to go unchallenged, as Thermotank claim to have carried out the first complete air conditioning installation on any vessel built outside the U. S. A. The vessel concerned was the British Tanker Company's M. V. *British Empress* and is, we believe, the first wholly air conditioned vessel in the world.

Thermotank of Glasgow, who are responsible for approximately seventy-five percent of the air conditioning installed in ships built in Britain, have also

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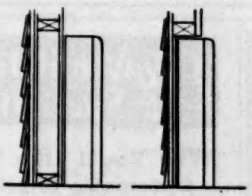

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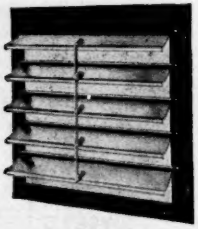

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Geo. A. Somerville
Sales Controller

Thermotank Inc.,
Detroit, Mich.

Getting Personal

H. E. Degler

Howard E. Degler *(Selection, Operation and Maintenance of Industrial Cooling Equipment,* page 65) came to The Marley Company as technical director on January 1, 1948, from The University of Texas where he had been professor of mechanical engineering and chairman of the department since 1930. During the year July 1945 to July 1946 he was in Europe with the U. S. Army in the Information and Education Division.

He is a mechanical engineering graduate from Lehigh University and received his Master's degree from the University of Illinois where he was on the M. E. faculty for eight years. Mr. Degler has had industrial experience with such companies as Babcock & Wilcox, General Electric, Bethlehem Steel, Atlantic Refining, and Sargent & Lundy. He has done research and consulting work in heat power, gas and oil engines, refrigeration, and air conditioning.

Mr. Degler has also written several engineering textbooks on heat-power subjects and contributed frequently to engineering publications.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

ASME MEETING—Fall meeting of the American Society of Mechanical Engineers, at the Radisson Hotel, Minneapolis, Minn. C. E. Davies, secretary of the Society, 29 West 39th St., New York 18, N. Y. .....**SEPTEMBER 25-28, 1951.**

PLUMBING AND HEATING MEETING—Annual meeting of the Plumbing and Heating Industries Bureau, at Palmer House, Chicago, Illinois. Norman J. Radder, secretary of the Bureau, 35 East Wacker Drive, Chicago 1, Illinois. **OCTOBER 11, 1951.**

ELECTRICAL ENGINEERS CONFERENCE—A Technical conference on the application of frictional horsepower motors to refrigeration equipment and pumps, sponsored by the American Institute of Electrical Engineers, at the Dayton Biltmore Hotel, Dayton, Ohio. D. C. Breeding, Frigidaire Division, General Motors Corp., Dayton, Ohio. .....**OCTOBER 11-12, 1951.**

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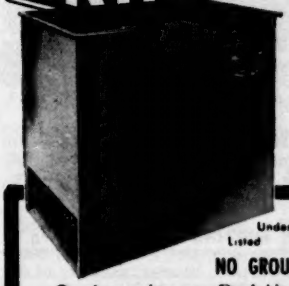

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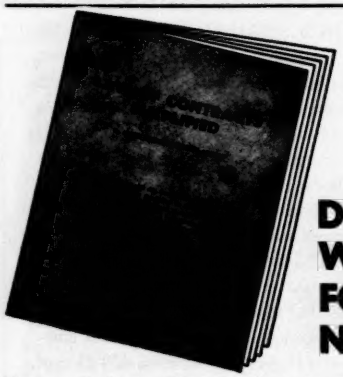

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AGA CONVENTION—33rd annual convention of the American Gas Association, at Kiel Auditorium, St. Louis, Mo. Secretary of the Association, 420 Lexington Avenue, New York 17, N. Y. ..... **OCTOBER 15-17, 1951.**

PUBLIC HEALTH MEETING — 79th annual meeting of the American Public Health Association, at Civic Auditorium, San Francisco, Calif. Willimina Rayne Walsh, associate secretary of the Association, 1790 Broadway, New York 19, N. Y. ..... **OCTOBER 29—NOVEMBER 2, 1951.**

REFRIGERATION SHOW—7th All-Industry Refrigeration and Air Conditioning Exposition, at Navy Pier, Chicago, Ill. Show director, REMA 1346 Connecticut Ave., N.W., Washington, D. C. ..... **NOVEMBER 5-8, 1951.**

STEEL BOILER MEETING—National meeting of the Steel Boiler Institute, at the Shoreham Hotel, Washington, D. C. R. A. Locke, secretary, Land Title Building, Philadelphia 10, Pa. ..... **NOVEMBER 8-9, 1951.**

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **NOVEMBER 25-30, 1951.**

CHEMICAL EXPOSITION—23rd Exposition of Chemical Industries, at Grand Central Palace, New York. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. ..... **NOVEMBER 26—DECEMBER 1, 1951.**

CHEMICAL ENGINEERS MEETING—Annual meeting of the American Institute of Chemical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Institute, 29 West 39th St., New York 18, N. Y. ..... **DECEMBER 2-5, 1951.**

ASRE MEETING—Annual meeting of the American Society of Refrigerating Engineers, at the Hotel Roosevelt, New Orleans, La. M. C. Turpin, secretary of the Society, 40 W. 40th St., New York, N. Y. ..... **DECEMBER 2-5, 1951.**

HEATING WHOLESALERS' MEETING—Annual meeting of the National Heating Wholesalers' Association, at the Hotel Statler, Cleveland, Ohio. E. L. Wyman, executive secretary, 609 Commerce Building, Cleveland. ..... **DECEMBER 3-4, 1951.**

WARM AIR CONVENTION—38th annual convention of the National Warm Air Heating and Air Conditioning Association, at Hotel Cleveland, Cleveland, Ohio. George Boeddener, 145 Public Square, Cleveland. ..... **DECEMBER 5-6, 1951.**

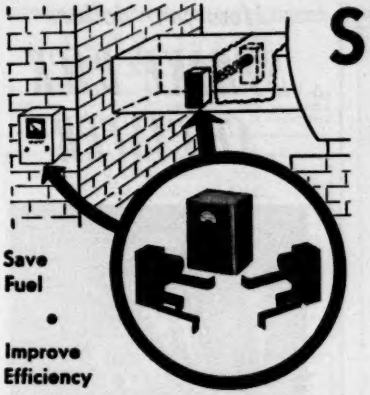
PLANT MAINTENANCE SHOW AND CONFERENCE — 3rd plant maintenance show and conference, at Convention Hall, Philadelphia, Pa. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **JANUARY 14-17, 1952.**

AUTOMOTIVE ENGINEERS MEETING — Annual meeting of the Society of Automotive Engineers, Inc., at the Hotel Book-Cadillac, Detroit, Mich. John A. C. Warner, secretary of the Society, 29 West 39th St., New York 18, N. Y. ..... **JANUARY 14-18, 1952.**

ELECTRIC ENGINEERING MEETING—Winter general meeting of the American Institute of Electrical Engineers, at the Hotel Statler, New York, N. Y. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. ..... **JANUARY 21-25, 1952.**

ASHVE MEETING—58th annual meeting of the American Society of Heating and Ventilating Engineers, in St. Louis, Mo. A. V. Hutchinson, secretary of the Society, 51 Madison Ave., New York 10, N. Y. ..... **JANUARY 28-30, 1952.**

OIL HEAT EXPOSITION—National Oil Heat Exposition, at Commercial Museum, Philadelphia, Pa., in conjunction with the 29th annual convention of Oil-Heat Institute of America, at the Benjamin Franklin Hotel. R. H. L. Becker, secretary of the Institute, 6 East 39th St., New York 16, N. Y. ..... **APRIL 14-18, 1952.**



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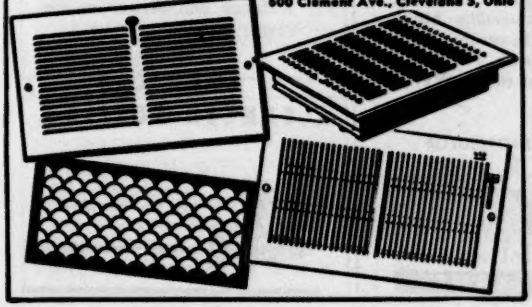

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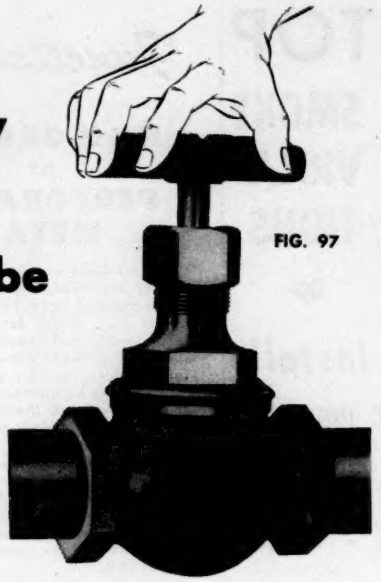

FIG. 97

JOB-FITTED with the *right* disc for every service

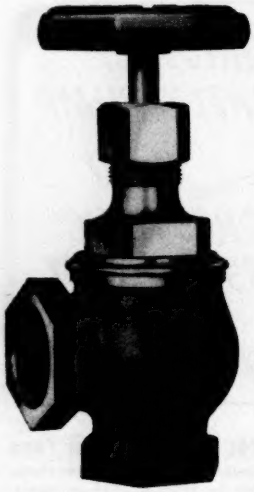

FIG. 98

TO ASSURE LONG, TROUBLE-FREE OPERATION with easy maintenance, the complete KENNEDY Line is *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

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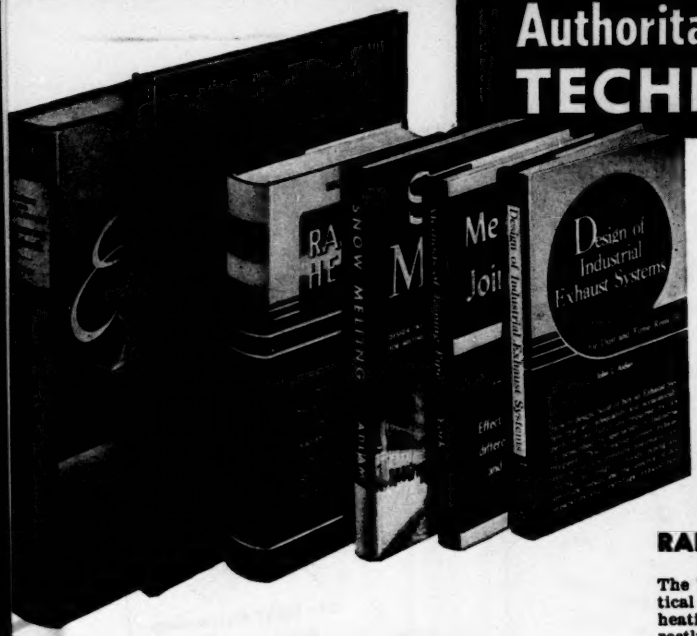

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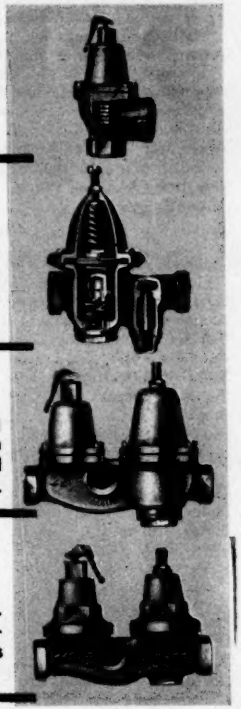

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Temp. Diff.	Multiply By
80	1.143
75	1.071
70	1.000
65	.929
60	.857
55	.786
50	.714

AREA IN SQ FT	VALUE OF U IN BTU PER HR PER DEG TEMP DIFFERENCE PER SQ FT																					
	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28
	BTU HEAT LOSS AT 0-70 DEG TEMPERATURE DIFFERENCE																					
1	4	5	6	6	7	8	8	9	10	11	11	12	13	13	14	15	15	16	17	18	18	19	20
2	8	10	11	13	14	15	17	18	20	21	22	24	25	27	28	29	31	32	34	35	36	38	39
3	13	15	17	19	21	23	25	27	29	32	34	36	38	40	42	44	46	48	50	53	55	57	59
4	17	20	22	25	28	31	34	36	39	42	45	48	50	53	56	59	62	64	67	70	73	76	78
5	21	25	28	32	35	39	42	46	49	53	56	60	63	67	70	74	77	81	84	88	91	95	98
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7	29	34	39	44	49	54	59	64	69	74	78	83	88	93	98	103	108	113	118	123	127	132	137
8	34	39	45	50	56	62	67	73	78	84	90	95	100	105	112	118	123	129	134	140	146	151	157
9	38	44	50	57	63	69	76	82	88	95	101	107	113	120	126	132	139	145	151	158	164	170	176
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13	55	64	73	82	91	100	109	118	127	137	146	155	164	173	181	191	200	209	218	228	237	246	255
14	59	69	78	88	98	108	118	127	137	147	157	167	176	186	196	206	216	225	235	245	255	265	274
15	63	74	84	95	105	116	126	137	147	158	168	179	189	200	210	221	231	242	252	263	273	284	294
16	67	78	90	101	112	123	134	146	157	168	179	191	201	213	224	235	246	258	268	280	291	302	314
17	71	83	95	107	119	131	143	155	167	178	190	202	214	226	238	250	261	274	286	298	309	321	333
18	76	88	101	113	126	138	151	164	176	189	202	214	226	238	252	265	277	290	302	315	328	340	353
19	80	93	106	120	133	146	160	173	186	200	213	226	239	253	266	279	292	306	319	333	346	359	373
20	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308	322	336	350	364	378	392
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25	105	123	140	158	175	193	210	228	245	263	280	298	315	333	350	367	385	403	420	438	455	473	490
26	109	127	146	164	182	200	218	237	255	273	291	310	327	346	364	382	400	419	437	455	473	491	510
27	113	132	151	170	189	208	227	246	265	284	302	321	340	359	378	397	416	435	454	473	491	510	529
28	118	137	157	176	196	216	235	255	274	294	314	333	352	372	392	412	431	451	470	490	510	529	549
29	122	142	162	183	203	223	244	264	284	305	325	345	365	386	406	426	447	467	487	508	528	548	568
30	126	147	168	188	210	231	252	273	294	315	336	357	378	399	420	441	462	483	504	525	546	567	588
31	130	152	174	195	217	239	260	282	304	326	347	369	391	412	434	456	477	498	521	543	564	586	608
32	134	157	179	202	224	247	269	291	314	336	358	381	403	426	448	470	493	515	538	560	582	605	627
33	139	162	185	208	231	254	277	300	324	347	370	393	416	439	462	485	508	531	554	578	601	624	647
34	143	167	190	214	238	262	286	309	334	357	381	405	428	452	476	500	524	547	571	595	619	643	666
35	147	171	196	221	245	270	294	318	344	368	392	417	441	466	490	515	539	564	588	613	637	662	686
36	151	176	202	227	252	277	302	328	354	378	403	428	454	478	504	529	554	580	605	630	655	680	706
37	155	181	207	233	258	285	311	337	364	388	414	440	466	492	518	544	570	596	622	648	673	699	725
38	160	186	213	239	266	293	319	346	373	399	426	452	479	505	532	558	585	612	638	665	692	718	745
39	164	191	218	246	273	300	328	355	383	410	437	464	491	519	546	573	601	628	656	683	710	737	764
40	168	196	224	252	280	308	336	364	392	420	448	476	504	532	560	588	616	644	672	700	728	756	784
41	172	201	230	258	287	316	344	373	402	431	459	488	517	545	574	603	631	660	689	718	746	775	804
42	176	206	235	265	294	324	353	382	412	441	470	500	529	559	588	617	647	676	706	735	764	794	823
43	181	211	241	271	301	331	361	391	422	452	482	512	542	572	602	632	662	692	722	753	783	813	843
44	185	215	246	277	308	339	370	400	432	462	493	524	554	585	616	647	678	708	739	770	801	832	862
45	189	220	252	284	315	347	378	410	442	473	504	536	567	599	630	662	693	725	756	788	819	851	882
46	193	225	258	290	322	354	386	419	452	483	515	547	580	612	644	676	708	741	773	805	837	869	902
47	197	230	263	296	329	362	395	428	462	494	526	559	592	625	658	691	724	757	790	823	855	888	921
48	202	235	269	302	336	369	403	437	471	504	538	571	605	638	672	706	739	773	806	840	874	907	941
49	206	240	274	309	343	376	412	446	481	515	549	583	617	652	686	720	755	789	823	858	892	926	960
50	210	245	280	315	350	385	420	455	490	525	560	595	630	665	700	735	770	805	840	875	910	945	980
51	214	250	286	321	357	393	428	464	500	536	571	607	643	678	714	750	786	821	857	893	928	964	1000
52	218	255	291	328	364	401	438	473	510	546	582	619	655	692	728	764	801	837	874	910	946	983	1019
53	223	259	297	334	371	408	445	482	520	557	594	631	668	705	742	779	816	853	890	928	965	1002	1039
54	227	264	302	340	378	416	454	491	530	567	605	643	680	718	756	794	832	868	907	945	983	1021	1058
55	231	269	308	347	385	424	462	501	540	578	616	655	693	732	770	809	847	886	924	963	1001	1040	1078

HEAT LOSSES FOR VARIOUS U-VALUES AND AREAS

AREA IN SQ FT	VALUE OF U IN BTU PER HR PER DEG TEMP DIFFERENCE PER SQ FT																					
	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28
	BTU HEAT LOSS AT 0-70 DEG TEMPERATURE DIFFERENCE																						
56	235	274	314	353	392	431	470	510	550	588	627	666	706	745	784	823	862	902	941	980	1019	1058	1098
57	238	278	318	358	399	438	479	519	560	598	638	678	718	758	798	838	878	918	958	998	1037	1077	1117
58	244	284	325	365	406	447	487	528	569	609	650	690	731	771	812	853	893	934	974	1015	1056	1096	1137
59	248	289	330	372	413	454	496	537	579	620	661	702	743	785	826	867	909	950	991	1033	1074	1115	1156
60	252	294	336	378	420	462	504	546	588	630	672	714	756	798	840	882	924	966	1008	1050	1092	1134	1176
61	256	299	342	384	427	470	512	555	598	641	683	726	769	811	854	897	938	982	1025	1068	1110	1153	1196
62	260	303	347	391	434	478	521	564	608	651	694	738	781	825	868	911	955	998	1042	1085	1128	1172	1215
63	265	308	353	397	441	485	529	573	618	662	706	750	794	838	882	926	970	1014	1058	1103	1147	1191	1235
64	269	313	358	403	448	493	538	582	628	672	717	762	806	851	896	941	986	1030	1075	1120	1165	1210	1254
65	273	318	364	410	455	501	546	592	638	683	728	774	819	865	910	956	1001	1047	1092	1138	1183	1228	1274
66	277	323	370	416	462	508	554	601	648	693	739	785	832	878	924	970	1016	1063	1109	1155	1201	1247	1294
67	281	328	375	422	469	516	563	610	658	704	750	797	844	891	938	985	1032	1078	1126	1173	1219	1266	1313
68	286	333	381	428	476	524	571	619	667	714	762	809	857	904	952	1000	1047	1095	1142	1190	1238	1285	1333
69	290	338	386	435	483	531	580	628	677	725	773	821	869	918	966	1014	1063	1111	1159	1208	1256	1304	1352
70	294	343	392	441	490	539	588	637	686	735	784	833	882	931	980	1029	1078	1127	1176	1225	1274	1323	1372
71	298	347	398	447	497	547	596	646	696	746	795	845	895	944	994	1044	1093	1143	1193	1243	1292	1342	1392
72	302	352	403	454	504	555	605	655	706	756	806	857	907	958	1008	1058	1109	1159	1210	1260	1310	1361	1411
73	307	357	409	460	511	562	613	664	716	767	818	868	920	971	1022	1073	1124	1175	1226	1278	1329	1380	1431
74	311	362	414	466	518	570	622	673	726	777	829	881	932	984	1036	1088	1140	1191	1243	1295	1347	1398	1450
75	315	367	420	473	525	578	630	683	736	788	840	893	945	998	1050	1103	1155	1208	1260	1313	1365	1418	1470
76	319	372	426	478	532	585	638	692	746	798	851	904	958	1011	1064	1117	1170	1224	1277	1330	1383	1436	1490
77	323	377	431	485	539	593	647	701	756	809	862	916	970	1024	1078	1132	1186	1240	1294	1348	1411	1455	1509
78	328	382	437	491	546	601	655	710	765	819	874	928	983	1037	1092	1147	1201	1256	1310	1365	1430	1474	1529
79	332	387	442	498	553	608	664	719	775	830	885	940	995	1051	1106	1161	1217	1272	1327	1383	1448	1493	1548
80	336	392	448	504	560	616	672	728	784	840	896	952	1008	1064	1120	1176	1232	1288	1344	1400	1456	1512	1568
81	340	396	454	510	567	624	680	737	794	851	907	964	1021	1077	1134	1191	1247	1304	1361	1418	1474	1531	1588
82	344	401	459	517	574	632	689	746	804	861	918	976	1033	1091	1148	1205	1263	1320	1378	1435	1492	1550	1607
83	349	406	465	523	581	639	697	755	814	872	930	988	1046	1104	1162	1220	1278	1336	1394	1453	1511	1569	1627
84	353	411	470	529	588	647	706	764	824	882	941	1000	1058	1117	1176	1235	1294	1352	1411	1470	1529	1588	1646
85	357	416	476	536	595	655	714	774	834	893	952	1012	1071	1131	1190	1250	1309	1369	1428	1488	1547	1607	1666
86	361	421	482	542	602	662	722	783	844	903	963	1023	1084	1144	1204	1264	1324	1385	1445	1505	1565	1625	1686
87	365	426	487	548	609	670	731	792	854	914	974	1035	1096	1157	1218	1279	1340	1401	1462	1523	1583	1644	1705
88	370	431	493	554	616	678	739	801	863	924	986	1047	1109	1170	1232	1294	1355	1417	1478	1540	1602	1663	1725
89	374	436	498	561	623	685	748	810	873	935	997	1059	1121	1184	1246	1308	1371	1433	1495	1558	1620	1682	1744
90	378	441	504	567	630	693	756	819	882	945	1008	1071	1134	1197	1260	1323	1386	1449	1512	1585	1638	1701	1764
91	382	446	510	573	637	701	764	828	892	956	1019	1083	1147	1210	1274	1338	1401	1465	1529	1603	1656	1720	1784
92	386	451	515	580	644	709	773	837	902	966	1030	1095	1159	1224	1288	1352	1417	1481	1546	1620	1674	1739	1803
93	391	456	521	586	651	716	781	846	912	977	1042	1107	1172	1237	1302	1367	1432	1497	1562	1638	1693	1758	1823
94	395	461	526	592	658	724	790	855	922	987	1053	1119	1184	1250	1316	1382	1448	1513	1579	1655	1711	1777	1842
95	399	466	532	599	665	732	798	865	932	998	1064	1131	1197	1264	1330	1397	1463	1530	1596	1673	1729	1796	1862
96	403	470	538	605	672	739	806	874	942	1008	1075	1142	1210	1277	1344	1411	1478	1546	1613	1680	1747	1814	1882
97	407	475	543	611	679	747	815	883	952	1019	1086	1154	1222	1290	1358	1426	1494	1562	1630	1708	1765	1833	1901
98	412	480	549	617	686	755	823	892	961	1029	1098	1166	1235	1303	1372	1441	1509	1578	1646	1725	1784	1852	1921
99	416	485	554	624	693	762	832	901	971	1040	1109	1178	1247	1317	1386	1455	1525	1594	1663	1733	1802	1871	1940
100	420	490	560	630	706	770	840	910	980	1050	1120	1190	1260	1330	1400	1470	1540	1610	1680	1750	1820	1890	1960
200	840	980	1120	1260	1400	1540	1680	1820	1960	2100	2240	2380	2520	2660	2800	2940	3080	3220	3360	3500	3640	3780	3920
300	1260	1470	1680	1890	2100	2310	2520	2730	2940	3150	3360	3570	3780	3990	4200	4410	4620	4830	5040	5250	5460	5690	5880
400	1680	1960	2240	2520	2800	3080	3360	3640	3920	4200	4480	4760	5040	5320	5600	5880	6160	6440	6720	7000	7280	7560	7840
500	2100	2450	2800	3150	3500	3850	4200	4550	4900	5250	5600	5950	6300	6650	7000	7350	7700	8050	8400	8750	9100	9450	9800
600	2520	2940	3360	3780	4200	4620	5040	5460	5880	6300	6720	7140	7560	7980	8400	8820	9240	9660	10080	10500	10920	11340	11760
700	2940	3430	3920	4410	4900	5390	5880	6370	6860	7350	7840	8330	8820	9310	9800	10290	10780	11270	11760	12250	12740	13230	13720
800	3360	3920	4480	5040	5600	6160	6720	7280	7840	8400	8960	9520	10080	10640	11200	11760	12320	12880	13440	14000	14560	15120	15680
900	3780	4410	5040	5670	6300	6930	7560	8190	8820	9450	10080	10710	11340	11970	12600	13230	13860	14490	15120	15750	16380	17010	17640
1000	4200	4900	5600	6300	7000	7700	8400	9100	9800	10500	11200	11900	12600	13300	14000	14700	15400	16100	16800	17500	18200	18900	19600

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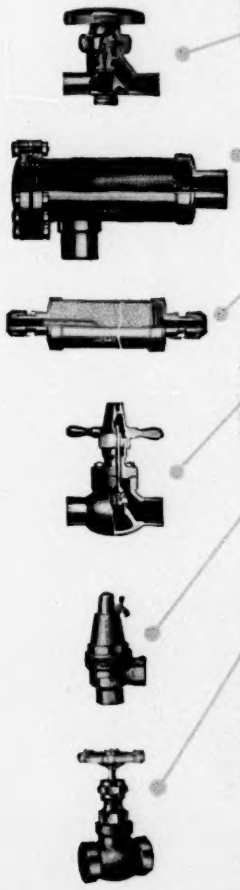
a few of many outstanding advantages



IN PACKLESS VALVES, still the only Balanced-Action valve on the market—no extra cost

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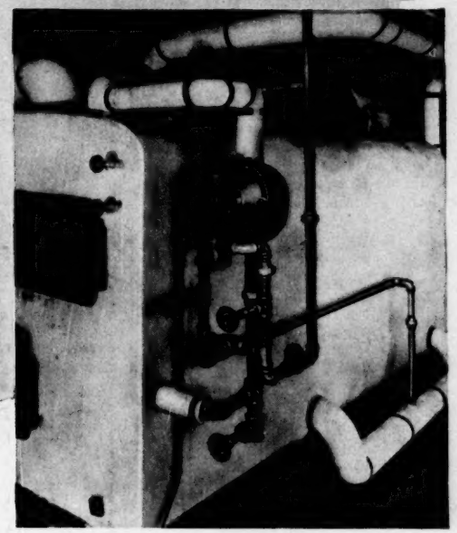
State of Massachusetts
Department of Public Safety
Rules for Low Pressure Heating Boilers
Section 5, Paragraph 93

AUTOMATIC WATER FEEDER: Where water of condensation of all of the steam generated by a boiler cannot be returned by gravity directly to the boiler, and pumps, traps or other devices are used for this purpose, or steam is used for purposes where there would be no water of condensation to return to the boiler, *an automatic water feeding device* shall be provided.



• Read this ruling in the Massachusetts Statutes covering automatic water feeders. We doubt if there is a heating man anywhere who would disagree with a single word of this ruling, and if it's right in Massachusetts, it's right anywhere. The boilers are the same in any State; low water trouble doesn't respect State lines.

This being the case, we suggest that you make this ruling your ruling. It doesn't require a law to make a smart man do the right thing, and the right thing for every steam boiler is a boiler water feeder.

Notice that the Massachusetts law, written after thoroughgoing research, points out the need for automatic *water feeding* where "pumps, traps and other devices are used." This confirms the opinion of foremost heating authorities that a mechanical means of feeding water is the first line of defense against low water. It recognizes the facts that a fuse can blow in a pump circuit, making a pump inoperative, or that return traps and other feeding devices, however dependable, can become temporarily inoperative. Under such conditions a boiler water feeder is the best safety device.

Rulings like this point up the need for boiler water level control on every boiler, but they cannot cover the most important fact of all—the fact that only the best water level control is good enough for the vital job of keeping the boiler water level where it belongs. In the opinion of a majority of heating men, McDonnell equipment alone is worthy of that trust.

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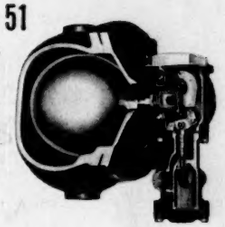
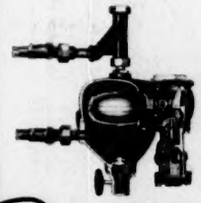
Doing One Thing Well

McDonnell No. 51

Boiler Water Feeder for boilers above 5000 sq. ft. capacity; maximum steam pressure, 35 lbs. For automatically fired boilers it is equipped with a low water fuel cut-off switch (No. 51-2).





McDonnell No. 47

Boiler Water Feeder for smaller boilers (below 5000 sq. ft. capacity), maximum steam pressure, 25 lbs. Also available with low water cut-off for automatically fired boilers (No. 47-2).

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